SCIENTIFIC AMERICAN

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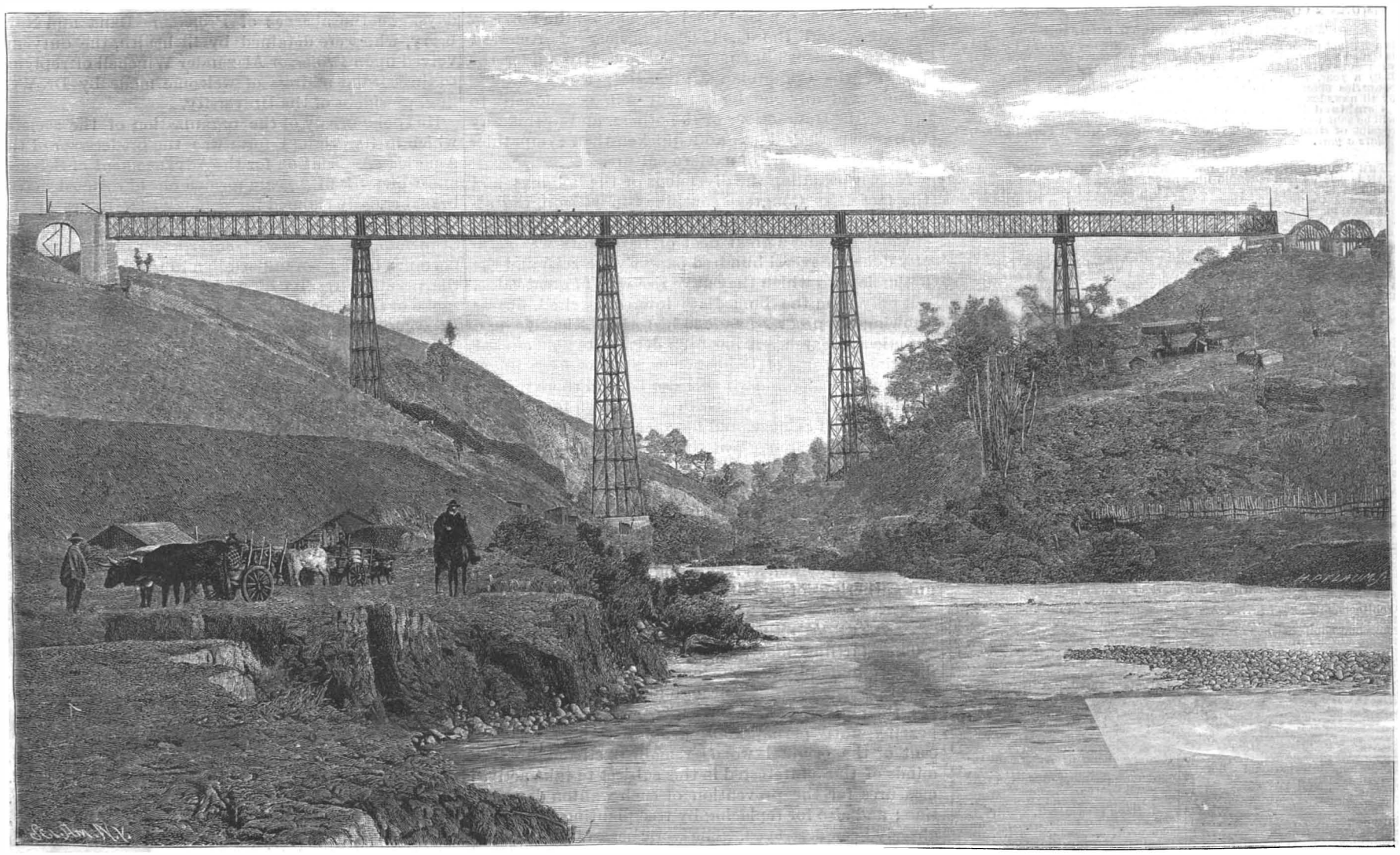
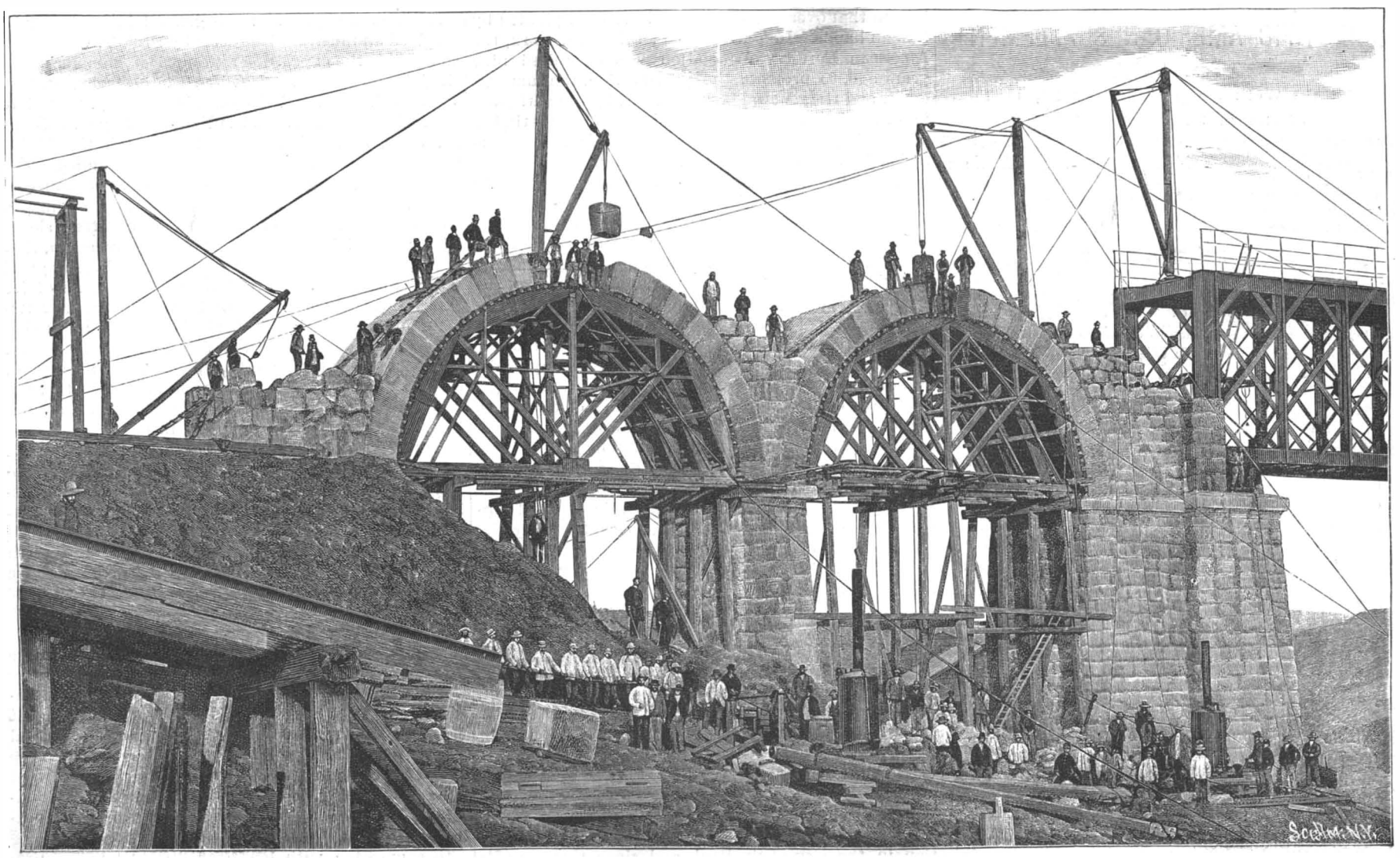


THE MALLECO VIADUCT, COLLIPULLI, CHILI.



ARCHES AT NORTH END, MALLECO VIADUCT, CHILI.—[See page 21.]

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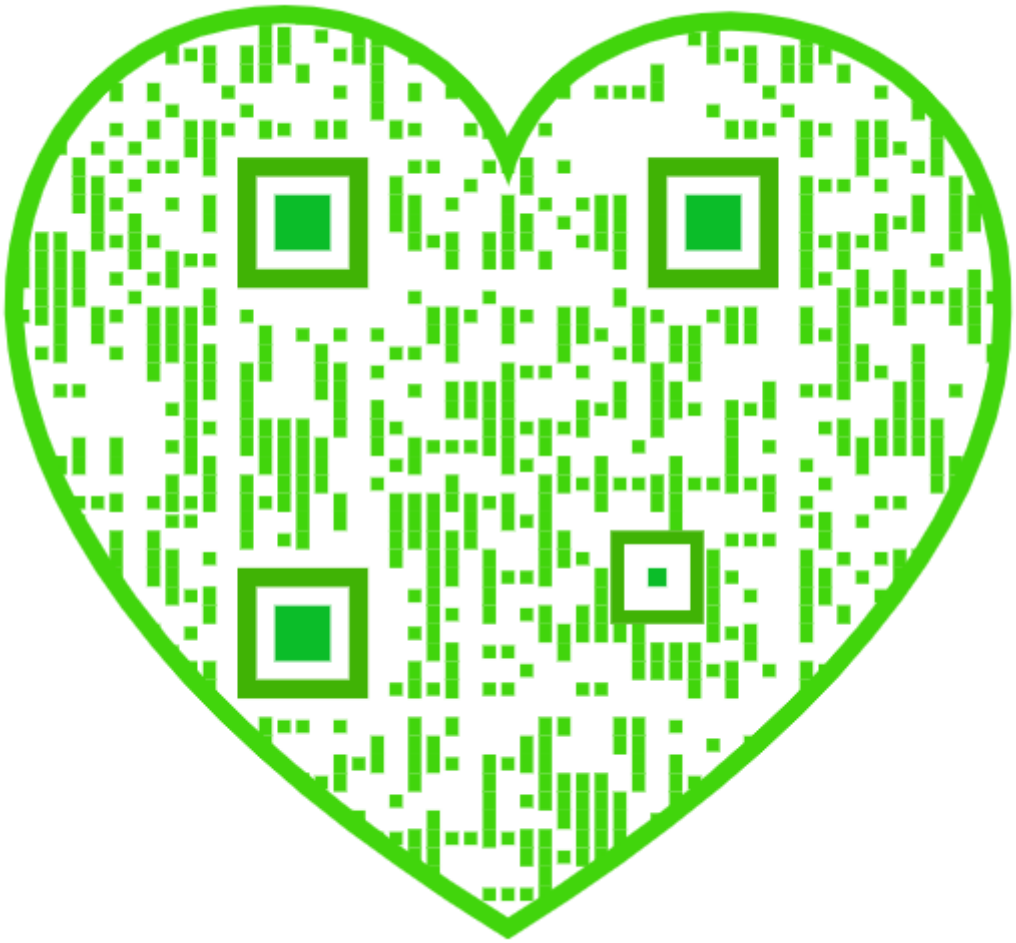

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WASHINGTON AS A CONVENTION CITY.

It is a notable fact that the recent holiday week has been made the occasion for the gathering of at least four great national scientific societies at the national capital, besides several important ecclesiastical conventions, to say nothing of an army of more than fifteen hundred school teachers coming in two parties from New York and New England. This is certainly an interesting sign of the times. The advantages of such a winter meeting place are obvious; among them being the general attractions of the locality, the accessibility by railroad, the hospitality of the citizens, and above all the facilities furnished by the immense libraries and museums. The scientific bodies thus meeting have been the American Economic Association, the American Historical Association, the Forestry Congress, and the Geological Society of America. Three of the societies met simultaneously under the roof of the Columbian University; thus enabling members of any one body to drop in occasionally to witness the transactions of the others, and in this way to broaden their ideas and quicken their sympathies with various phases of modern culture.

Notwithstanding the diversions of the holidays, and the fact that Congress continued in session, the attendance upon the meetings was unusually large and enthusiastic and a great deal of hard work was actually done. Several hundred papers were read and the discussions to which they gave rise were of great value, not only from the immediate interest excited, but as showing the progress made in historical, scientific, and practical research. It has been decided to hold similar meetings of some of these bodies at Washington next August, in which month will also be held there the annual meeting of the American Association for the Advancement of Science, and likewise the International Geological Congress. The timely suggestion was made by some of the public-spirited citizens that it would be well to urge the erection of a suitable convention hall, with committee rooms and all needful appointments; as a means of ultimately concentrating in the locality at least the winter meetings of the various national associations, as well as furnishing facilities for important gatherings of a political and commercial nature.

THE AMERICAN FORESTRY CONGRESS.

The startling fact that, before the woodman's ax, fires originated by hunters and by sparks from numerous railroads running through all parts of the country, the native forests of America were rapidly disappearing, until, perhaps, only from ten to fifteen per cent of the original woods remained, stirred up the minds of those interested in this subject to take active measures for the prevention of such wanton destruction; and also for replacing by tree-planting what had already been destroyed. The work began in Nebraska for economic purposes eighteen years ago. The very first year it was officially reported that 12,000,000 trees had been planted; and now, in that one State, it is known that over 600,000,000 trees have been planted by human hands. In pursuance of this good work, the American Forestry Association was organized nine years ago, to promote the preservation, the management, and the renewal of our forests, by the gathering in of statistics, the securing of appropriate timber acts, and by the suitable education of the rising generation in this regard. The total membership, as reported at the recent Washington meeting, is now 224; and among the beneficial results already secured is the actual establishment of special national reservations, such as the Sequoia tract of 350,000 acres in Tulare County, California, the Yellowstone and Yosemite, and other national parks. Concerning this part of the work, the Forestry Association has now passed resolutions in favor of withholding from sale all forest lands under national and State control; largely extending the boundaries of existing parks (so far as may be desirable), approving the recent request made by the Secretary of the Interior for companies of cavalry to protect the same; the exclusion of railroads from such parks, and the indorsement of all public and private efforts for the preservation of the Adirondack forests in New York, and those in the White Mountain regions in New Hampshire; regulating the sale of wood supplies under a system of licenses, so as to satisfy the various needs of those in the lumber business, and to superintend the proper manner of cutting so as to secure reforestration. The officers elected at the meeting, which was held in the Agricultural Department, were: President, William Alvard, of Cleveland; treasurer H. M. Fisher; recording secretary, N. H. Egleston; corresponding secretary, E. A. Bowers.

Among those present and participating in the papers and discussions were Secretary Willets, Dr. F. B. Lovering, Col. Henry Strong, Prof. W. W. Folwell, Hon. B. E. Fernow, Mr. Gifford Pinchot, and Hon. B. G. Northrop, and many others.

To Mr. Northrop the nation is especially indebted for what is known as "Arbor Day," an idea suggested by him eight years ago, at the meeting of the association in the city of St. Paul, and since then so efficiently carried out by him as chairman of the committee appointed for the purpose, that thirty-seven States have adopted the day. As illustrating the work accomplished by Arbor Day, it is reported that in Pennsylvania during the past seven years 300,000 trees have been planted by the school children; and in the State of New York 50,000 have been planted during the past two years. The importance of this peculiar work, together with his establishment of successful village improvement societies in various parts of the country, entitle Mr. Northrop to be regarded as a national benefactor.

THE GEOLOGICAL SOCIETY OF AMERICA.

The second annual gathering of American geologists was held in the chemical lecture room of the Columbian University at Washington, D. C., during the holidays. In the absence of Professors Dana and Newberry, who were detained by ill health, the duty devolved upon Professor Alexander Winchell of replying to the cordial address of welcome made by Dr. Welling, president of the University.

He spoke briefly of the organization of the society, which in its original form was the predecessor of the American Association for the Advancement of Science, and which for fifty years formed one of its most active branches. He claimed for geology that it lies at the foundation of the multiform culture of modern life. Stupendous and costly enterprises of national importance have been undertaken in the development of the practical results of geological investigation. He spoke of the ethical influence of this particular science in promoting conscientious study, and claimed that if its methods prevailed in every-day affairs, the consequences would be highly beneficial. The study of geology in our public schools should be encouraged because it develops the imagination, the powers of generalization, and indeed every faculty of the human mind, so that it is a crime against the youth of our land to exclude it from any grade of their school life.

Although the conditions of fellowship in this society are exacting and somewhat expensive, it has already enrolled 202 members, most of whom are in professional work. It has published one volume of its bulletin, and another will shortly appear. It has also begun an excellent work in the collection of rare and original photographs illustrating gorges, chasms, dikes, bosses, buttes, mines, cataracts, and the like.

The officers elected for the coming year are: President, Alexander Winchell, of Ann Arbor, Michigan; vice-presidents, G. K. Gilbert, Washington, D. C., and T. C. Chamberlain, of Madison, Wisconsin; H. L. Fairchild, secretary; H. S. Williams, of Cornell University, treasurer; editor, W. G. McGee, of Washington, D. C. During the three days' session which was held morning, afternoon, and evening, more than 50 papers were read, some of them of very considerable length, all of which go into the hands of the executive council to be published in full or by abstract in the proceedings, at their discretion.

Among the papers of more general interest may be specified an illustrated address by Prof. T. C. Russell, concerning the expedition sent out last summer under the joint auspices of the United States Geological Survey and the National Geographical Society, to explore the region lying between the Yakutat Bay and Mount St. Elias, in Alaska. Examples of both the Alpine and continental types of glaciers were studied. The former exist in great variety in every cañon and valley, amid the mountains, some of them ending in sea walls of solid ice, others situated on steep slopes with no well-defined limits, while others, again, flow out from the mountains through broad valleys as great rivers of ice that unite to form a vast plateau of ice that has forced back the sea. Such plateaus are termed "Piedmont glaciers." A glacier of this nature between Yakutat Bay and the south base of Mount St. Elias, known as the Malospina glacier, has an area of 500 square miles; and west of that mountain there is an extension of the same ice field whose limits are unknown. These fields are similar in many respects to the great Laurentide system. Along the coast bergs are continually breaking off and floating away. Toward the interior the character changes, the region being indented by profound crevasses, while other portions form plains overlaid by soil, so that the phenomenon is presented of a luxuriant floral growth and groves of considerable size flourishing above beds of ice varying in thickness from 500 to 1,000 feet.

Professor G. F. Wright, of Oberlin, O., gave the results of two months' field work amid the extensive lava beds of the Snake River region, in Idaho, having in view the determination of the age of several remarkable lava deposits. His observations began at Soda Springs in the valley of the Bear River, extended thence northward to Beaver Canon, eastward to the Yellowstone Falls in the National Park, southward to Jackson's Hole, and westward crossing Teton Mountains to Market Lake, thence down the valley to Huntington, Oregon.

In connection with Professor Wright's paper, Professor George F. Becker, of San Francisco, described well authenticated discoveries of highly finished ab-

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original implements in the auriferous gravels underlying the basaltic deposit on the summit of Tuolumne Table Mountain. His remarkable statements were confirmed by the affidavits of the workmen who discovered the implements. He was followed by Professor Cope, and Thomas Wilson, curator of the Smithsonian Institution, and others, the outcome of it all being that fully 300 specimens of the sort have been found in a formation usually regarded as Pliocene. The discussion of these extraordinary facts bearing upon the antiquity of the human race was so absorbing that it lasted until nearly midnight, the final impression seeming to prevail among those that took part in it that the glacial age on the Atlantic side of the continent must have long antedated the glacial age as developed on the Pacific coast. Of course a discussion of this kind brought up to view the little image found in boring, also the famous old Calaveras County skull, and similar debatable matters, but the whole discussion was carried on in the greatest spirit of fairness and good feeling.

Prof. W. N. Davis, of Cambridge, Mass., described two fossil-bearing belts found in the Triassic formation of Connecticut. This formation, as interpreted by the dislocation of the trap sheets, is found to be divided by oblique faults into a number of blocks with displacements, varying up to 2,000 ft. All the known fish-bearing shales have been correlated as the disjointed outcrops of only two shale belts. It will certainly be a surprise to the general reader to be told that, following these indications, Dr. E. O. Hovey found last summer fossil fish in the vicinity of New Haven.

Among other notable papers read were those describing the glacial lakes of Canada, the coal-bearing rocks of Montana, the geology of Georgia, the phosphate deposits on the island of Nevassa, the nickel and copper deposits of the Sudbury district in Canada, the occurrence of Medina sandstone on the summit of the Blue Ridge at Harper's Ferry, etc.

We have the promise for early publication of Prof. N. H. Darton's description of the formations characterizing the region immediately around the city of Washington, D. C., which, of course, will have more than a purely local interest.

By the courtesy of the authors we are also able, in the SCIENTIFIC AMERICAN SUPPLEMENT of this week, to publish Prof. Orton's remarkable account of a finely preserved megalonyx found within the past month by Mr. W. S. Hanna, of Millersburg, Ohio; and an exceedingly interesting paper by Prof. Henry McCalley on the "Coal Fields of Alabama."

THE NEW COPYRIGHT BILL NOW BEFORE CONGRESS.

The copyright bill which passed the House December 3, 1890 (H. R. 10,881) contains nearly all of the objectionable features of the original Senate bill. It is now before the Senate, and there is opportunity for amendments. We hope strenuous efforts will be made in this direction; but the most satisfactory way would be to postpone the matter until the next session of Congress; thus giving chance for further and more deliberate discussions than the limited time now permits. The subject is one of paramount importance to the public, deserving the most careful study and cautious action on the part of the national legislature.

We had occasion some time ago to discuss the merits of a bill substantially similar to this one, and perhaps we cannot do better than repeat in substance some of the principal points then presented.

The bill has for its ostensible motive the grant of book patents to foreign authors; but it is well understood the real object of the bill is to facilitate, by aid of Congress, the formation of book trusts, by which the prices of books will be advanced throughout the country, the rich publishers made richer and the printers of cheap literature driven out of business. Under the law as it stands, only the books of American authors and of foreign authors resident here can be patented; all others are free, and there is no mode by which the people can be deprived of cheap books, or those who make them deprived of occupation. But if this foreign copyright bill passes, all books can be patented, the rich publishers will purchase the patents and put up the prices, and only those who control the patents can continue in business.

Probably there are few who will dispute the propriety of granting copyright patents, in some form, for a limited period, to foreign authors; but in doing so every care should be taken to preserve existing advantages and to prevent injury to established industries. The present bill appears to be lacking in these respects, and is open to other objections.

The bill in substance provides that on and after July 1, 1891, book patents shall be granted to foreigners; they may hold these monopolies for forty-two years; the assigns of foreigners may also obtain such patents. The Postmaster-General and the Secretary of the Treasury with their aids and assistants throughout the United States are constituted pimps and ferrets for these foreigners; it is made their duty to spy out and seize all books going through the mails that infringe the copyrights of foreigners; if an American citizen coming home from abroad brings with him a purchased book on which he has already paid royalty to the author, it is to be seized on landing unless he can produce the written consent of the man who owns the copyright for this country, signed by two witnesses. Who the said owner may be, in what part of the world he lives, the innocent citizen must find out as best he can, or be despoiled of his property.

The bill also provides for book patent reciprocity with other nations—a very taking idea, but without real merit. Is it desirable to saddle the people of the United States with a mass of 42 year book patents because other countries do so?

These are some of the strange provisions of the Senate bill, which, it is obvious, needs amendment.

The period allowed for these monopolies, namely, forty-two years, is altogether too long. The ordinary patent for an industrial improvement, such as the sewing machine, the planing machine, the telegraph, the telephone, or any other invention, however wonderful or vast its benefits to the people, is only granted for seventeen years. The patent then expires, the monopoly ceases, and the people are at liberty freely to copy and duplicate the invention.

It would be much more satisfactory to the public if the term of the foreign copyright were reduced to five or ten years, and we trust an amendment to this effect will prevail. At the time the House was engaged in passing this objectionable bill the Grangers, then in session at Osceola, were discussing a resolution demanding that all patents should be limited to ten years, and it was only by a narrow vote that it was not made a prominent plank in the platform. The popular feeling is unquestionably adverse to the grant of patent monopolies of any kind for so long a period as 42 years, and it will be well for our statesmen to respect this feeling.

In considering the question of changing the statute, we ought not to overlook the benefits that have accrued to the country from the law as it now stands, and which has worked satisfactorily for more than fifty years. It would be folly to change for the worse.

Under the influence of the present copyright laws, our home publishers have for years been enabled to fill the country with the choicest books and periodicals at the lowest prices. The educative effects of this vast supply of standard literary matter have been astonishing. We have become the greatest reading people in the world.

Says Mr. Andrew Carnegie in his "Triumphant Democracy:" "It is estimated there are twenty-three thousand school libraries in America, containing forty-five million books—*twelve million more than all the public libraries of Europe combined.* Other educational establishments increase this number by two and a half million volumes, and thirty-eight State libraries contribute over a million more. The Congressional library, the Astor, the Boston City, the Philadelphia, the various mercantile libraries, the Watkinson reference at Hartford, and many others will raise the grand total to much more than fifty million volumes—a book almost for every man, woman, and child in the United States. More than three hundred libraries contain ten thousand volumes each, twelve contain more than a hundred thousand volumes each, and two contain four hundred thousand volumes each. Even this statement but feebly shadows forth the truth as to the books and periodicals of the country, as compared with those of other lands, for the American is not only a reader, but he is above all other men a buyer of books. Circulating libraries are not so generally used as in Europe. It is when you enter the home of the American farmer or artisan that you are struck with the number of books and magazines you see—the two or three shelves and often far greater number filled with them.

"Triumphant Democracy is triumphant in nothing more than in this, that her members are readers and buyers of books and reading matter beyond the members of any government of a class, but in this particular each system is only seen to be true to its nature. The monarchist boasts more bayonets, the republican more books."

It is not unreasonable to assume that the greatest impulses toward the attainment of our present position in respect to popular education, intelligence, and native authorship have been derived, directly or indirectly, from the existing copyright law, which excludes foreigners and encourages American citizens. Independently of these advantages, the law has helped to develop some of the largest industries. It has created enormous establishments for the manufacture of paper, chemicals, types, printing presses and engines. It has called to employment multitudes of operatives. It gives volume to the mails, helping to freight and support the railways, steamers, telegraphs, and other adjuncts of civilization.

Upon the American author the copyright law, as it stands, confers important benefits. It secures to him the exclusive right to his writings for forty-two years. No citizen who can produce anything worth reading lacks for employment or emolument. It is agreed on all sides that no country was ever blessed with so many able authors as the United States. They ought to be well rewarded, and under the law as it stands they are. It would be easy to give many examples; a few must suffice. Of "Uncle Tom's Cabin," by Mrs. Stowe, some two millions of copies have been sold; of "Ben Hur," by General Wallace, 250,000 copies; of Roe's works, hundreds of thousands of copies. Some of the story papers, filled with copyrighted tales, sell four hundred thousand copies of each issue, aggregating many millions per year. Mark Twain is said to have made five hundred thousand dollars clear profit within five years from his copyright patents. He receives a handsome royalty on every volume sold. Mr. Blaine has derived a great fortune in the same manner. Mrs. Grant is reported to have received three-quarters of a million dollars as her share of proceeds from the sale of the great general's book, and the copyright patent has forty years still to run.

The money paid to American authors remains within the country. The extension of copyright monopoly to foreigners will enable them to draw millions out of the country.

To this it may properly be answered, if we grant copyright to foreigners, then foreign nations will in duty be bound to allow similar rights to Americans; and so the money will come back. But we fear there is little equality in the matter. American readers and book buyers are as five to one, the world over. The financial result of the patent book extension would be in the same ratio adverse to the United States.

Everybody wants a patent, especially every book publisher. The real though hidden object of this bill—the negro in the fence—is to increase the price of books, and thereby swell the profits of publishers. But the "hurrah" on which the bill was carried in the House was "the natural right of every man to the enjoyment of his own property." It was claimed that when a man invents a new thing or writes a new book, it is *his property*, in which he has an inalienable personal, exclusive, natural, divine, perpetual property right. But this is fallacious. No man has a natural right to any species of property. His person, his time, his efforts, his productions, all belong, by natural law, to the community of which he is a member; this natural law requires that every individual shall, at all times, employ his best powers of body and mind for the benefit of the community. In so doing he promotes his own welfare as well as that of his fellows. The bosh and nonsense of the book patent people, who claim divine patents and property rights for authors, and denounce others as thieves, has been exposed on various occasions by the Supreme Court of the United States; for example, in Dable *v.* Flint the court said:

"To the argument of the plaintiff's counsel, that the statute is unconstitutional, as depriving the inventor of his property without compensation, there is a two-fold answer. '*The patentee has no exclusive right of property in his invention, except under and by virtue of the statute securing it to him, and according to the regulations and restrictions of those statutes.*"

The object of our statesmen should be to encourage and promote the printing of books as much as possible, secure reasonable rewards to authors, and protect them from the grasp of greedy publishers. This might be accomplished by making a few simple amendments to the present law, among them the following:

"Sec —. No assignment of a copyright by the author shall be valid, but the copyright shall remain vested solely in the author, or in his wife or children if he be dead; and any persons desiring to publish a copyrighted work may do so on payment to the author of a royalty not exceeding ten per cent on the lowest price at which said work is sold by said publisher."

An amendment of this kind would be likely to prove beneficial to the public. It would not seriously interfere with free printing. It would promote rivalry between publishers in their endeavors to supply the people with the best editions at the lowest prices; this everybody wants; it would also secure to authors, native or foreign, a reasonable reward for their labors; and this also would give general satisfaction.

Col. Wm. H. Paine.

We regret to announce the death of Col. Wm. H. Paine, which occurred in Cleveland, O., on December 31, 1890. He was born in Chester, N. H., in 1828. He was from early life a surveyor and engineer. He won his reputation in the army by his exploits in the engineering corps during the civil war. He went into the field in advance of the Northern army and obtained dimensions for the construction of bridges where the Confederates had destroyed the old ones. His connection with the Brooklyn bridge, where he was assistant engineer from the beginning of the work to its completion, made him well known in this city. He studied the cable system of traction, and it is his system of grip that is used to-day on the bridge. The 125th Street cable road in this city was built from his plans.

At the time of his death he was in charge of the construction of the cable road in Cleveland, as he had come to be recognized as an authority on cable traction.

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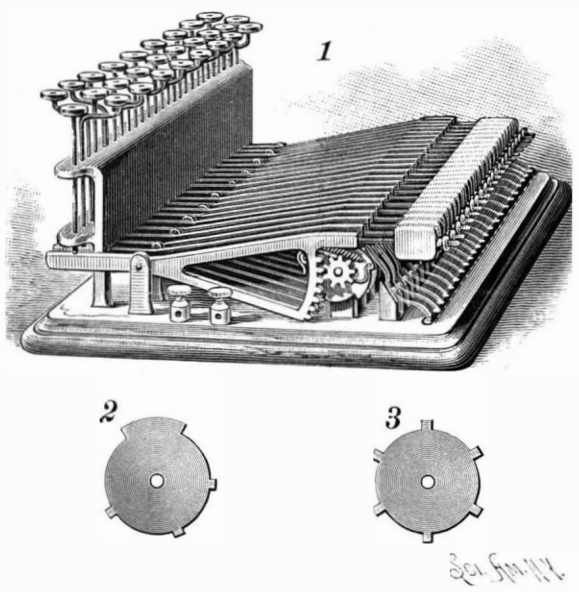
A French Fast Train.

A new locomotive built in the shops of the Northern Railroad has been tried at high speed, with a special train of 16 carriages, having a total weight of 667,800 lb. Lead bars were put in the carriages to represent the average weight of passengers, baggage, etc., carried on an express train. This train ran from Paris to Calais by the direct line, a distance of 184·56 miles, in 3 hours, 53 minutes; two stops were made, one of five minutes at Amiens, the other of two minutes at Abbeyville. The average speed, making no allowance for stops, was 47·53 miles an hour. The run from Paris to Amiens was made at the rate of 51·58 miles an hour, the train going up the Survilliers grade—0·5 cent., 11·19 miles long—at the rate of 46·6 miles an hour. On the return trip another carriage was added, making 17 in all. From Calais to Lille the average speed was 49·7 miles an hour, the highest speed 59 miles. Between Lille and Paris the average speed was about the same, but a speed of 71·46 miles an hour was reached in going down the Survilliers grade.—*Iron Trade Review.*

AN EASILY OPERATED TELEGRAPH INSTRUMENT.

The illustration represents an instrument designed to facilitate the transmission of telegraphic messages with speed and accuracy. It has been patented by Dr. Samuel W. Smith, of No. 24 West Thirtieth Street, New York City. Aligning vertical supports on a suitable base carry horizontal shafts on which are disks having projections varying in length, and adapted by means of varying contact with the trailer to transmit dots and dashes. The disk used in sending one of the longer characters is shown in Fig. 2, which represents a "v" in the Morse alphabet, requiring a dash and three dots, Fig. 3 showing a disk used in sending one of the shorter characters, as the letter "e," which would be represented by a dot. Fixed on each disk-carrying shaft is a ratchet wheel, adjacent to which is a pinion



SMITH'S TELEGRAPH TRANSMITTER.

carrying a spring-pressed pawl, with other mechanism, the arrangement being such that the character disks may be given a whole revolution or any part of a revolution by each movement of the key, the motion being limited and regulated by the mechanism. Each key rests on an outer projecting end of a carriage pivoted between vertical supports, there being near the opposite end of the carriage a segmental rack meshing with the pinion on a disk-carrying shaft, the carriage also having a projecting screw-threaded portion carrying a weight adjustable by means of a nut. Each key is marked with a letter corresponding with the projections on one of the disks, and any person who can read the letters can operate the transmitter, it being only necessary to depress a key to transmit a letter. The movement of the sending mechanism is regulated by the downward movements of the weights, whereby the motion of the character disks is made steady, and accuracy and rapidity are assured. Each key and its mechanism works independently, forming a transmitter in itself. This instrument may be adapted to any code of signals.

The Bordeaux International Exhibition of 1891.

Active steps are being taken in the preparation of this exhibition, which will be opened on the 1st of May, 1891. The exhibition will cover an area of 60,000 square meters, and will be divided into five sections, viz.:

I. Education, liberal arts, furniture, textiles, and clothing.

II. Miscellaneous industries, machinery, mineralogy, chemistry, electricity, etc.

III. Food stuffs, import and export trade, navigation, salvage, fishery, and fish culture.

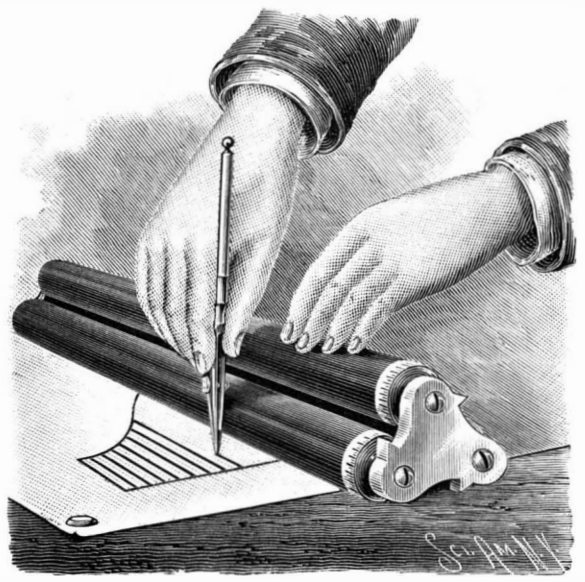
IV. Agriculture, viticulture, horticulture, etc.

V. Fine arts.

Exhibits are invited from all countries, and applications for space should be addressed to Henri Garcin, 7 Allees de Tourny, Bordeaux.

AN IMPROVED PARALLEL RULER.

A simple and convenient device to facilitate ruling with a pen, pencil or brush is shown in the accompanying illustration, and has been patented by Mr. Reginald Forwood, of Paris, Texas. It is made of three



FORWOOD'S PARALLEL RULER.

rollers journaled triangularly in end bearings, the bearings not extending marginally beyond the peripheries of the rollers. The rollers may be made of metal tubing, with plugs in the ends of the tubes to receive screws to act as journals. The ends of the rollers, at one or both ends, have peripheral graduations set or gauged to an index pointer on the adjacent end bearing, whereby, after one line is drawn, the ruler may be rolled a measured distance for the ruling of the following line. These graduations may be spaced differently on the different rollers, to facilitate making evenly spaced parallel lines at different distances apart. The ruler may be set or run along on any two of the rollers.

A Great Magnet.

Hughes & Gawthorp had on exhibition at the Pittsburg exposition an electro-magnet designed for lifting pig iron from the pig bed in the cast house. It was manufactured by the Thomson-Houston Motor Company. This magnet had a lifting capacity of 7,200 pounds. In shape it somewhat resembled a bell with nearly vertical sides, standing about 20 inches in height, and measuring about 24 inches across the bottom. The thickness of the sides of the bell, if it may be termed such, is about 3 inches, and within the bell and being flush with it at the bottom was a large coil forming a powerful electro-magnet. The coil is made a magnet by the passage of a current of electricity through it. The magnet, which is attached to a crane, can be raised and lowered. The lode can be dropped by simply shutting off the current.

The Prophylaxis of Diphtheria.

A *resume* of this subject is furnished by Prof. Loffler, of Greifswalde. The cause of diphtheria is a bacillus, which, contained in the exudation on the affected mucous membranes, is liable to be disseminated in the vicinity of the patient, together with particles of the false membrane. The infectivity of the patient may even persist for some days after all traces of diphtheritic exudation have disappeared. The strictest isolation of cases is necessary; children who have suffered from the disease should be kept from school for at least four weeks. The bacilli have been found to retain their vitality in dry membranes for from four to five months. It is therefore essential that all clothing, bed linen, and utensils likely to have been contaminated should be disinfected, either by boiling or by exposure to steam. The room occupied by the patient should be disinfected by washing the floors with warm sublimate solution (1 in 1,000), and cleansing the walls and furniture with bread.

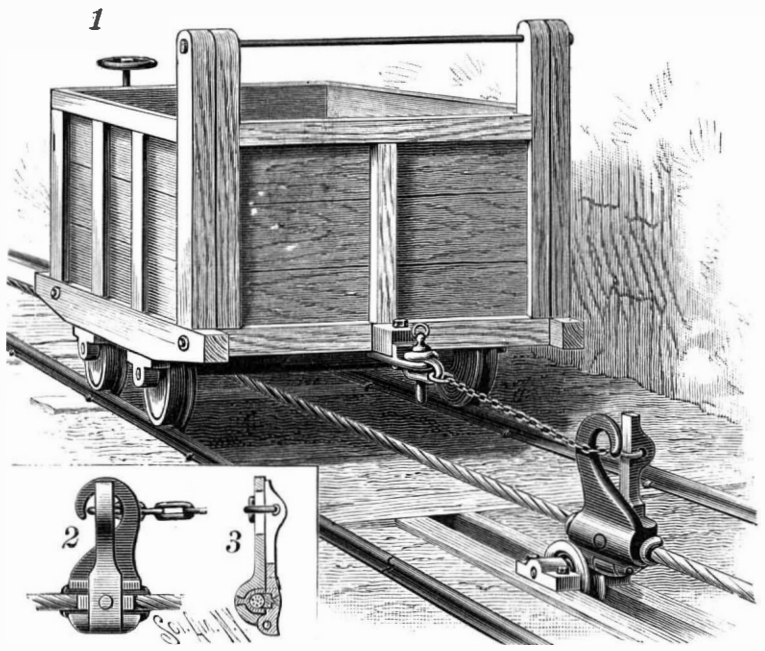
It is uncertain how long the bacilli may exist in the moist state, but it seems probable that moisture is more favorable to their vitality than dryness. Thus, diphtheria would seem to be favored by the dampness of dwellings, and also by absence of light. These organisms can exist outside the body at a temperature of 68 degrees F., and they develop well in milk. The sale of milk should, therefore, be carefully supervised. The diseases affecting pigeons, fowls, calves, and pigs which resemble diphtheria are not caused by the bacillus of human diphtheria. These diseases in the lower animals are not, therefore, to be feared as sources of the human affection. Professor Loffler thinks that the etiological identity shown by Klein to exist between diphtheria in cats and in man requires confirmation. Although lesions of mucous membranes favor the retention of the virus, yet in disposed subjects the disease may arise apart from such lesions. It is advised that when diphtheria is prevalent, a systematic use of disinfectant gargles and washes (*e. g.*, sublimate solution, 1 in 10,000) should be enforced on all children. The meteorological conditions which favor the spread of the disease are still unknown.—*Berliner Klinische Wochenschrift; Medical Record.*

A Lucky Escape.

An unusual whirr of machinery, a hissing and twisting of a broken belt and a shower of small pieces of broken iron in the dynamo room at the Lowell electric light station, a few nights ago, startled all the employes within hearing. Something had broken. As the engineer rushed in to shut off the steam and stop the swiftly running engine he saw a single black streak cutting the air where once had been a heavy fifty-inch pulley, a network of torn wires and a pile of twisted belting. In this room there are two large dynamos for supplying motor power to the electric railway and a circuit of street lights and private motors. On the main shaft are two large fifty-inch pulleys, one of which burst into a thousand pieces and the other was broken and cracked so that it could not be run. When the pulley broke, the force with which the belt flew off lifted everything loose from the floor above. Small pieces of broken wire were thrown with terrific force in all directions, but strange, and very fortunate, besides the broken pulley and belt, very little other damage was done. At the time of the break there was no one in the engine room.—*Modern Light and Heat.*

AN IMPROVED CABLE GRIP.

The grip shown in the illustration, while designed to be simple and durable in construction, is adpated to reduce the strain on the cable and car to a minimum, and is arranged to pass readily over the cable sheaves without displacing the cable. It has been patented by Mr. Elijah Dainty, of Coal Bluff, Pa. The grip has two members pivotally connected together at their lower ends, as shown in side elevation and transverse section in Figs. 2 and 3, one member having a slot in which is fitted a shoe adapted to receive the cable. The cable is clamped into the shoe by a shoe held in the other member, the cable being clamped when the two members are drawn together. The shoes are of a form to be readily fitted to place in the members, and each has an outwardly projecting pin passing into a countersunk aperture adapted to be filled with molten metal to lock the shoe in place. The free end of one member of the grip is connected with a chain which is passed through an eye or loop of the other member to attachment with the car, so that when tension is put upon the chain the members are drawn toward each other and the cable is firmly gripped. The heavier the pull on the chain, the tighter the members are drawn together. The members of the grip are opened sufficiently to apply it to the cable in starting, and when the car arrives at its destination the clevis pin connecting the chain to the car is withdrawn and the chain is thrown out of the eye of the grip, when the latter drops off the cable. When the shoes are worn out, they can be readily replaced by new ones after first



DAINTY'S CABLE GRIP.

cutting out the Babbitt or other metal around the pins which hold them in place. The lower parts of the two members of the grip are so rounded off that it readily travels over the grooves in the sheaves supporting the cable.

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THE GINSENG.

BY NICOLAS PIKE.

Few people are aware that the plant called ginseng, the root of which is of so much importance to our Celestial brothers on the other side of the world, is growing in our own country from Canada to the Southern States and west to the range of the Rockies. In the vicinity of the Catskill Mountains especially, and in the forests back of them, it is found in great abundance.

The American root is said not to be the genuine article, but it belongs to the same family (*Araliacia*) and the same genus (*Panax*) as the Chinese root, the former being the *P. quinquefolium*, Lam., and the latter *P. ginseng* of Meyer.

It is a perennial plant which sends up annually a smooth round stem about a foot high, which divides at the summit into three leaf stalks, each of which supports a compound leaf consisting of five (sometimes seven) petiolate, acuminate, serrate leaflets. It bears yellowish flowers and bright scarlet berries, a single plant often bearing 60 to 70 seeds. It has a fusiform root about as large as an index finger, with two to four rootlets, is brittle to the touch, and has a slightly bitter sweet taste. The name ginseng is said to signify "man plant," from a fancied resemblance in the root to the form of a human being.

The berries are fully ripe about the first of September, when they fall to the ground and are covered by the decayed leaves of the forest. There they lie for eighteen months before the young seedlings appear, as it takes that length of time for the seeds to germinate, and some years elapse before the root is ready for digging for commercial purposes. September is the month selected for collecting the roots, as at that time the plant has shed its seeds, and the sap has returned to the roots, making them heavier and consequently more valuable. Digging it before would in time exterminate the plant. Usually the root grows near the surface, but sometimes it sends a tap root deeper.

Strange to say, though the roots acquire value from age, they do not increase much in size, five ounces being a rare weight, but they seldom exceed two here. After gathering, they are washed perfectly clean and put in a cool place to dry, which requires nearly a month.

Artificial heat is said to deteriorate its medicinal qualities, but steaming is resorted to in order to whiten it. The larger, cleaner and more entire roots have greater value when put on the market.

Back of the Catskills is a forest extending over twenty miles, and there the ginseng grows in great abundance, and thousands of pounds are yearly gathered and sent to the New York market for exportation to China, as there is little use for it here. This simple plant gives employment to numbers of poor people in the country, gathering and preparing it for market.

I was quite surprised when on a short visit to the above mountain district to find that the whole population in the neighborhood, men, women and children, turn out "ginsening," as they term it. They close their houses for the day, take food in their baskets, and with a small spade trudge away among the woods and often go many miles into their depths. Sometimes they collect as much as ten pounds in a day, of the green roots.

There have been so many people engaged in this business the last few years that the plants are becoming scarce, and if care is not taken, they will soon be exterminated in this particular neighborhood of ginseng which will pay them handsomely if well cared for. The American root is said to be rich in gum and starch. Some people have acquired a taste for it and chew it like gum. At first, when the ginseng was exported to China, it commanded fabulous prices, but so much has been rushed on the market, and often of inferior quality, that its value is greatly deteriorated.

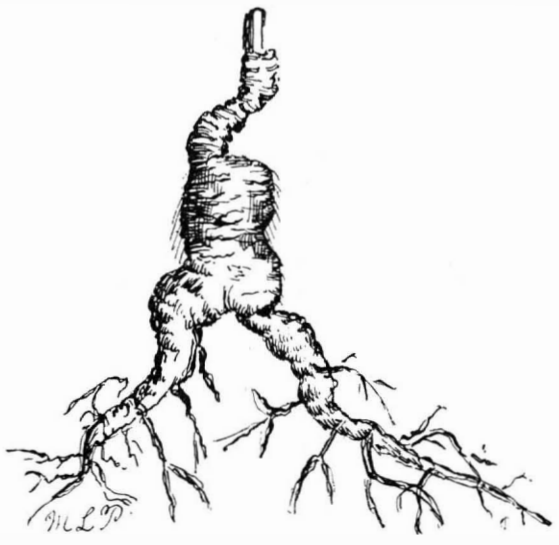
There are two other ginsengs in America, but they are easily distinguished from the *quinquefolium*. The dwarf ginseng, *P. trifolium*, has a round root, white flowers, purplish stems and only three leaflets on the leaf stems. The third species, *P. horridum*, is a prickly plant and grows west of the Rocky Mountains.

American ginseng is mostly shipped to Hong Kong, and is reckoned in quality next to Chinese and Corean. It realizes here from $2 to $4 per pound. There are several grades, and in China they average superior, selected root $450 per picul,* large selected $380, good ordinary $300, medium $270, fair $250. Extra choice large and heavy have at times commanded fancy prices, even to $1,000 per picul. The exports from America are nearly 500,000 pounds per annum.

Many attempts have been made to cultivate ginseng in America, but with little success till recently. At Summit Station, N. J., is what is known as Stanton's ginseng farm, and there its cultivation is a fixed fact. This gentleman began experimenting five or six years ago, and has not only raised the seeds but transplanted the young plants with perfect success. This will doubtless open up a new industry, important to those who own forest lands where they can establish plantations

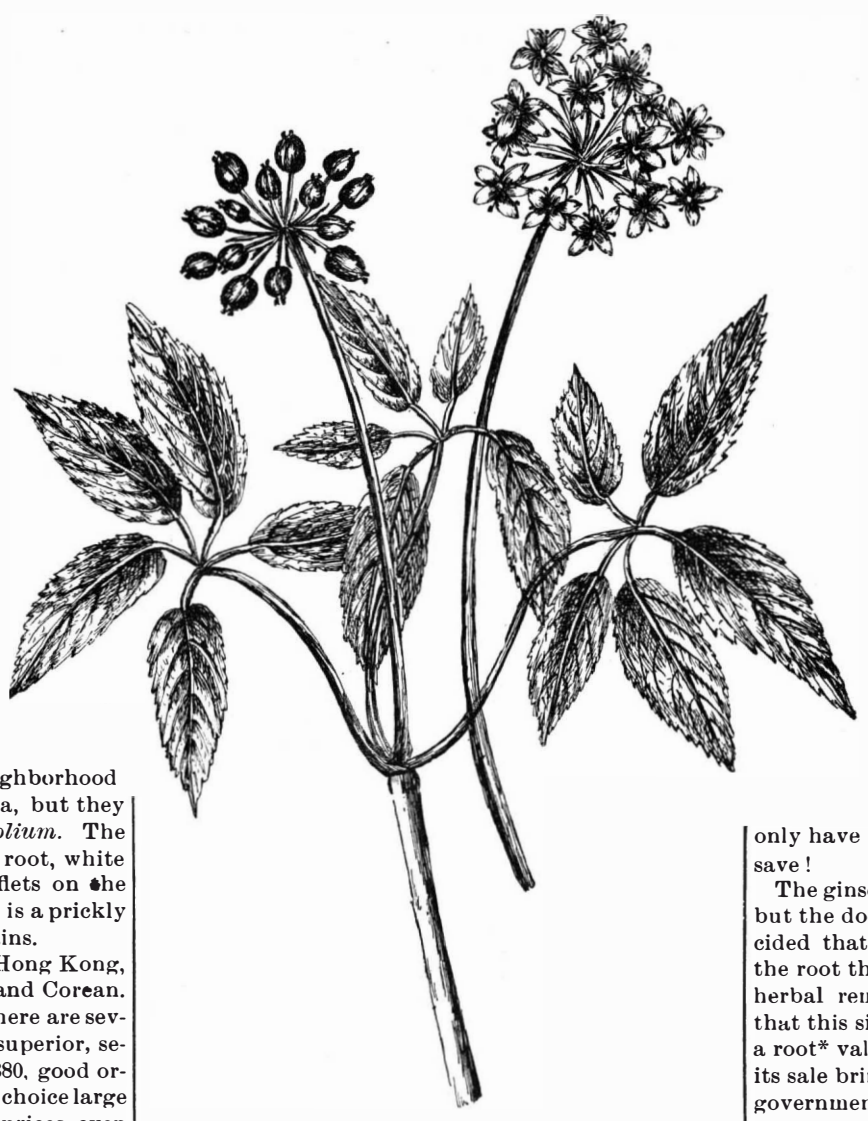
* A picul is 133⅓ pounds.

The Chinese consider the ginseng as an infallible



ROOT OF THE GINSENG OR MAN PLANT.

cure for every known disease. It is called in their language "ling-pao-you-y-tau," that is, "supernatural treasure for all desires." The great difficulty exists in varying the dose and combining it with some suitable liquid. This wonderful medicine is often given in the shape of small red pills not larger than a pea (a pure homeopathic dose). The component parts of these pills it is said are not known, but the secret has been held in one family for centuries. The sale of these pills is immense and they are sold by weight. A silver bar or coin is placed in one scale and the pills in another. A missionary once told me that a Jesuit priest had submitted some of these pills to chemical examination, and he found ginseng and red pepper the principal ingredients, though there were other drugs he did not know in minute quantities.



PANAX QUINQUEFOLIUM—GINSENG.

This root, from its fancied resemblance to the form of a man, excites as much superstition and fear among the ignorant Chinese as the mandrake formerly did in Western Europe. Like it, they believe that when torn from the ground it emits cries and groans, and in some remote places it is dug up with fear and trembling, as it is supposed to be guarded by the wolf, tiger, leopard, and snake in the gloomy forest depths it loves, and can crawl under the ground if it pleases.

Ginseng is both wild and cultivated in China, but the former is the more highly prized. It is called jenshen, and in Quantung and Manchuria is an imperial perquisite. So expensive is it that few save the wealthiest people can use it. Speaking of the Manchurian root, it is said "to love moisture and the depths of forests, and nestles in recesses where the sun never penetrates."

The Chinese believe that a root which has been created in the form of man must have been intended to cure all his ills. They assert that the wild root will prolong life for days after a person has been at the last gasp.

The effects of the ginseng are supposed to be alterative, tonic, stimulant and demulcent. That grown in the various provinces is carefully marked with locality, as each appears to possess some different quality.

China receives her supply from Corea, Japan and America, as well as from her own growth. The Corean is considered next to the native Chinese, then the American (called the *yang-seng* or foreign), and the Japanese.

The Manchurian ginseng is given preference over all others, and when carefully selected and clarified sells for its weight in gold, and is used mostly by the imperial family. The Corean is one of the articles of tribute sent annually from the court of Corea to that of China, and is highly valued. It is said to take 30 years to come to perfection. Much is cultivated, but only the wealthy can afford to grow it, as the poorer classes cannot set apart their ground for years and devote their time to it. There is, however, an inferior quality found wild, largely exported. The Corean is said to be highly tonic and stimulant to persons suffering from nervous debility, etc. The American is considered a most effective remedy in all fevers, and in convalescence from febrile affections and other ailments.

The ginseng cultivated near the river Amoor, in the north, grows in sandy soil. The seed is sown in spring, and the roots taken up in autumn, when they are stored in a room above freezing point, and covered with dry earth. Next spring they are planted out and again taken up in autumn, and this is repeated for four or five years, until the plant has attained fair growth.

Very little is used by the people in the north, where the soil is dry and climate cool, but in the south the Chinese use it in both drinks and food as a precautionary measure against sickness, where there are great heat and moisture. Pills, confections, and infusions are the principal ways of using the root, the latter the most common. The Chinese Tartars also use ginseng extensively. They boil it in their soup every morning, and a half-ounce dose is considered a cure for consumption. Everywhere the greatest care is required to preserve the roots from damp and the attacks of worms, and decoctions are almost always made in silver vessels. The imperial government claims a tax on all the ginseng collected in that vast empire, which is willingly paid for such a panacea.

Even in the most out of the way places the druggists, or, rather, herbalists, as they deal so largely in plants and roots, put a sign over their doorposts indicating that "Here are sold ginseng and young deer's horn pills." A decoction of the root is most highly valued when a person is suddenly in the last extremity and unprepared for death. The medicine is said to ward off the terrible enemy for four or five days, thus giving the man a chance to arrange his family affairs, so that he can pass calmly and content to the other shore. If we could only have the same faith, how much trouble it would save!

The ginseng formerly had some reputation in Europe, but the doctors both there and in America have decided that there is so little real medicinal worth in the root that it has been discarded, like so many other herbal remedies of former days. How strange it is that this simple plant we think so worthless possesses a root* valued so highly in another hemisphere that its sale brings in an enormous revenue to the imperial government, and is used by millions of people with implicit faith in its efficacy. The Celestials look upon our distrust of it as another proof of the want of common sense in the "foreign devils," while they regard with still more contempt many a drug in vogue with our practitioners.

* The plant is held to be poisonous.

THE Académie des Sciences has submitted a new system of musical notation in which twenty-seven characters replace the 203 symbols now employed to represent the seven notes of the gamut in the seven keys.

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Cocoanut Butter.

A recent number of the *Kew Bulletin* contains an article on cocoanut butter, a valuable edible fat prepared from the kernel of the cocoanut and recently introduced into commerce. It is a white, odorless, almost tasteless fat, which solidifies at about sixty-five degrees Fah., becoming above that temperature a pure white oil.

"If cocoanut butter can be prepared, as is suggested, from the ordinary 'copra,' or dried kernel of the cocoanut, as shipped from tropical countries, there would be an almost unlimited supply of the raw material available from various parts of the world." According to Dr. Zerner, of the Royal Imperial and General Hospital in Vienna:

"The cocoanut butter, which, on account of its low melting point, is exported in tins, furnishes a pure white transparent mass of the consistence of lard, without granular texture, which at a temperature of seventy-nine degrees Fah. melts to a clear fluid and solidifies again at sixty-seven degrees Fah. It has a slight agreeable smell, melts on the tongue, leaving a mild but in no respect acrid taste behind it. In ether it dissolves completely. If the ether is evaporated over water and distilled water is added to the residue, the solution gives a neutral reaction. I have often repeated this test with cocoanut butter which had remained open for days (fourteen days), also with pharmaceutic preparations eight to fourteen days old, in the preparation of which cocoanut butter had been used. The cocoanut butter is, therefore, free from fatty acids, and even if left open for the space of eight to fourteen days does not turn rancid, with the exception of the top layer, which comes in contact with the air.

"With regard to its chemical composition, cocoanut butter differs from most other fats, and particularly butter, lard, and margarin. In its fatty constituents and the amount of volatile fatty acids, it stands next to butter among solid fats.

"Cocoanut butter differs from all other vegetable and animal fats by its saponification degree (258·5 according to Rud. Benedikt in Vienna), and on account of this high saponification degree all adulteration is impossible.

"Artificial digestion tests seem to show that the cocoanut butter exercises no injurious influence whatever over digestion.

"The next point was to ascertain how the cocoanut butter stands with regard to micro-organisms. It is well known that in this respect milk butter is very far from perfect, as apart from the numerous germs, which, for the most part, are not pathogenic, that may be introduced during its preparation, and the microbes already present in the milk itself, this article of food affords an excellent nutrient fluid for a large number of micro-organisms.

"It follows that, although in any given case other ways and means of infection may be excluded, this may still take place through the agency of milk and butter. The possibility of a transfer to the human consumer of the tubercle bacillus, as well as of other micro-organisms, which have got into the milk from animals suffering from infectious diseases, is in the case of cocoanut butter, a vegetable fat, excluded from the first. Cocoanut butter has been proved by our investigations to be both free from germs and also to be a very bad nutrient medium for micro-organisms. Even when agar-agar or Ceylon moss (*Gracilaria lichenoides*) was mixed with the cocoanut butter, and then allowed to remain open, the number of germs was found to be less than in agar-agar without the mixture of butter. One more experiment may be mentioned. If sterilized milk is added to cow butter and kept at a warm temperature, the milk coagulates in twenty-four hours, proving the presence of bacteria in the butter. This coagulation does not take place if, instead of milk butter, cocoanut butter is added to the milk.

"From what has already been said the conclusion may safely be drawn that the cocoanut butter, from a chemical and bacteriological point of view, meets all the requirements of a food substance.

"Our further investigations were directed to ascertaining whether cocoanut butter was suitable to healthly and sick people alike. Through a period of four weeks we distributed food to 116 patients in the form of pastry, roast meats, and farinaceous foods, in the preparation of which cocoanut butter was used in the place of fats.

"On account of this fat being almost free from water, one-quarter less may be taken, both in baking and cooking, than is generally used, if ordinary butter or lard is employed; and for the same reason it is necessary, in making pastry, to replace the twenty-five per cent of water, which the cocoanut butter contains less than any other fat, by adding from seven to eight tablespoonfuls to about every pound of butter used.

"A little more salt must be added to the food, and the butter must always be heated before being used for cooking. Foods prepared in this way, as well as pastry, were always found to be eaten without any inconvenience whatever. The taste was undoubtedly pleasanter than in dishes prepared with animal fats. The statement of a colleague, Dr. H., is of particular importance in this respect. After recovering from disorder of the stomach he could not eat pastry without being afterward troubled with pyrosis and cardiac pain. He could eat pastry prepared with cocoanut butter almost without any inconvenience.

The experiments with patients proved cocoanut butter to be an easily digested fat that causes no disorders in cases of impaired digestion. Of the 116 patients, among whom were individuals affected with every form of dyspepsia, not one complained of any discomfort or of any ill effect after the consumption of pastry prepared with cocoanut butter, though pastry, as a rule, is not an easily digested food on account of the fat. In three cases where the pastry was partaken of an hour after vomiting, there were no ill results noticeable; on the contrary, a fresh supply was desired by the patients.

"We arrive at the conclusion that a fat has been found in cocoanut butter which meets all hygienic requirements, and which is far superior to animal fat and butter, as well as to any of their other substitutes. Further, on account of its being easily digested, cocoanut butter is particularly well adapted for the use of patients suffering from impaired digestion."

A New Use for Cotton Seed Oil.

In a suitable metallic vessel of something more than one gallon in capacity is placed one gallon of pure cotton seed oil. There are now melted in a furnace in a suitable crucible or ladle twenty pounds of pure lead metal, care being taken that the entire quantity of the lead is in the molten state, which will insure a temperature thereof of not less than 334° of heat Centigrade. In this molten state the lead is then poured gradually in the one gallon of cotton seed oil, care being taken that the mixture is well stirred during the process of pouring, in order that, as far as possible, each molecule of the molten lead will be exposed to the action of the cotton seed oil. In this process of pouring the molten lead, as soon as the hot and molten metal strikes the surface of the oil it follows the law common to all molten metal when thrown in a liquid and separates into very minute globules, the bright and pure surfaces of which are brought in immediate contact with the cotton seed oil, and by the heat therefrom impart such affinity to the cotton seed oil in immediate contact therewith that a certain part of the lead will be absorbed by the cotton seed oil, which, when removed from the influence of the heated globule of lead, will immediately cool sufficient to retain therein the lead thus absorbed. When the entire twenty pounds of molten lead have been thus poured in the gallon of cotton seed oil, it is allowed to remain some little time to cool off, after which the oil is drawn off, and there will be found remaining in the bottom of the vessel in various forms about seventeen pounds of the pure lead, thus showing that in this one process of pouring about three pounds of lead have been absorbed by the one gallon of cotton seed oil. The remaining seventeen pounds of lead is now removed from the vessel, and the gallon of cotton seed oil, that has now about three pounds of lead therein, is returned to the vessel. The remaining seventeen pounds of pure lead is again heated and brought to the molten state, in which condition it is again poured in the cotton seed oil contained in the vessel, the same care being observed in stirring the mixture during the process of pouring as in the first pouring of the metal.

After this second process of pouring the molten lead in the cotton seed oil the mixture is allowed to cool sufficiently, when the oil is again drawn from the vessel, and there will now be found remaining about fifteen pounds of pure lead, thus showing that in this second process of pouring the molten metal two pounds of lead additional have been absorbed by the cotton seed oil, which will now contain about five pounds of lead combined therewith. This process of remelting the remaining lead and again pouring and mixing it with the same cotton seed oil is continued with advantage up to the fifth time of pouring the molten metal, after which the cotton seed oil will be found to have absorbed about ten pounds of the lead, after which there seems to be no further affinity of the oil for the metal. After the cotton seed oil has been brought to this stage it is allowed to thoroughly cool, when its consistency will be about that of ordinary paint. The compound is now in condition to be applied to those surfaces that it is desired to protect against corrosive or deteriorating influences, and may be applied with a sponge or brush, as in the application of ordinary paint. In applying the compound its adhesiveness will cause it to adhere tightly to the surface coated therewith. It is preferred to apply one coat and then allow it to remain about forty-eight hours, during which time it will have become sufficiently hard to resist ordinary abrasion, and after which a second coat may be applied with advantage.

Philip Helbig and Hermann Bertling, of Baltimore, Md., are the authors of this new article and process. They say: It has been found in practice that no other of the known oils, other than cotton seed oil, possesses the quality of absorbing the lead when treated as herein described, and that the cotton seed oil possesses the quality of absorbing certain proportions of other metals when poured therein in the molten state in the manner herein described.

As stated, the compound may be employed to protect metallic surfaces of any kind, and is claimed to be particularly useful for coating the bottoms of iron or steel ships to protect the surface thereof from rust and the adherence thereto of barnacles and other marine life. It is likewise of equal benefit for the protection of wooden surfaces that are to be buried in the earth or exposed to the action of water—such as fence posts, piles, etc.

Engineers as Inventors.

The old saying is that there is nothing new under the sun, but for all that some new idea is brought out every day. The field of invention has been pretty well plowed, cross-plowed, and subsoiled, and we are apt to think that there is but little chance further for discovery. The same was thought before the telephone or the electric light made fabulous fortunes for lucky (persistent would be the better adjective) inventors. While not every one can be a Bell, a Brush or an Edison, there is yet ample room for the exercise of all the inventive talent of which any man may be possessed. We do not know that stationary engineers would naturally be placed as inventors above any other class, but we believe that investigation would disclose that a large percentage of their number have devoted much time to invention and that a goodly average have developed inventions which have been more than ordinarily successful. To say nothing of smoke burners, rotary engines, etc., of which almost every engineer has his pet scheme, out of the one hundred and one appliances in the modern steam plant, many of them have been devised by operative engineers.

From the time when Humphrey Potter contrived a harness to move the valves of a pumping engine, in order to save himself labor, down to the present, the occupants of the engine room have been largely instrumental in developing the capabilities of the steam plant. They have the best of opportunity for discovering what improvement will increase its efficiency, make it more convenient or add to its safety. From seeing what is needed to devising ways and means to accomplish it is apparently an easy step, but it is one which involves persistent application and constant study. As an instance of what can be done in this way take the little device which we have seen illustrated lately. An engineer found it necessary to scrape the outside of the tubes in the boiler under his charge. Ordinary tools would not answer. So he straightway devised a little steel hook, and he not only had what he wanted, but what some one else wanted, and which they were willing to pay for. Or take the pump regulator invented by Mr. Campbell and illustrated in our last issue. It is the result of his having observed a want and having studied out a means of meeting it. There are many other wants yet to be met, and it only requires shrewd observation, a good knowledge of common mechanics and persistent effort to make the supplying of these wants a profit to the inventor.—*The Stationary Engineer.*

Test Paper for Acids.

BY S. J. HINSDALE, FAYETTEVILLE, N. C.

Cut white filtering paper of neutral reaction in pieces of about 6 inches square, and impregnate them with tincture of curcuma (1 part curcuma, 7 parts alcohol, and 1 part water). Place the paper on threads to dry. When dry pass a sheet of it through a bath composed of 40 drops of liquor potassæ and 100 c. c. water. Then immediately pass it through a bath of water (flat earthen dishes are convenient for the baths), and at once place it on a thread to dry. As soon as it is dry cut it in pieces and inclose them in tinfoil. The paper will not bear long exposure to light and air, but will keep well if inclosed in tinfoil.

It is much more sensitive than litmus paper, and will detect acid in a mixture of 1 part of hydrochloric acid in 150,000 parts of distilled water, and will detect carbonic acid in spring water. If the water be boiled to expel carbonic acid, and a yellow color is produced, some free acid (besides CO_2) is shown to be present.

The best way to use the paper is to touch it with a glass rod which has been wetted with the liquid to be tested.

The paper can be freshly prepared in fifteen or twenty minutes.—*Amer. Druggist.*

[*Note by Ed. Amer. Drugg.*—The author has sent us a specimen of the paper. We have tried it, and find it to be all that is claimed for it.]

Large Water Canal.

A portion of the surveys have been completed of the Owens River and Salt Wells Valley Canal in Inyo County. The canal will be 51 miles long, 60 feet wide and 8 feet deep.

An immense storage reservoir will be constructed at Little Lake and other points on the line.

It is estimated that there will be enough water to irrigate all of Salt Wells Valley, and leave a considerable surplus to be carried to the Mojave desert. The company will run a line of steamers in the canal.

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THE MALLECO VIADUCT, CHILIAN STATE RAILWAY, COLLIPULLI, CHILI.

Our illustrations are from photographs for which and for the following particulars we are indebted to Mr. Henry Blake, of Collipulli. The viaduct crosses a ravine and the Malleco River at Collipulli, in the southern part of Chili, 38° S. latitude, 72° 50′ E. of Greenwich. It is of steel, built by the Schneider Steel Company, at Creusot, France, and has the following dimensions:

Total length, 347 meters, 50 centimeters, divided into five spans of 69 meters 50 centimeters each.

Height of steel pier	No. 1,	43 meters,	70	centimeters.
" " " "	No. 2,	67 "	70	"
" " " "	No. 3,	75 "	70	"
" " " "	No. 4,	43 "	70	"
" " girders,		7 "	45	"

Total weight, 1,550 tons.
Total height from river 93 meters and 70 centimeters.

The metallic piers are bolted down on solid masonry built with best Portland cement and granite rock, piers Nos. 1 and 4 having a base of 15 meters and 98 centimeters by 12 meters and 40 centimeters.

Pier No. 2 has a base of 21 meters, 98 centimeters by 15 meters and 50 centimeters.

Pier No. 3 has a base of 21 meters and 60 centimeters by 15 meters and 50 centimeters.

They are built on the bed rock of the slope.

Height of rock piers No. 1 and No. 4, 14 meters and 90 centimeters.

Height of rock piers No. 2 and No. 3, 15 meters and 90 centimeters.

One of our views shows the solid stone arches at the north end. These arches as well as the piers are built up from the bed of rock. The metallic piers were first built, and the girder built on the north side of the ravine and launched forward on rollers moved by large ratchets, as you will see by photograph No. 1.

The great difficulty of this undertaking was the extreme steepness of the banks of the ravine, which caused a great deal of lost time in getting material to its place, there not being a bit of level ground within 2,000 feet of the bridge location.

This viaduct was projected and planned by the deceased engineer of Chilian Railways, Mr. Aurelio V. Lastarria, and carried out and finished by the present engineer, Mr. Eduard Vigneaux, a most indefatigable and enthusiastic engineer of the Chilian government.

Sand Transportation by Rivers.

James C. Graham, in a recent number of the *Amer. Jour. of Science*, says: There has recently come under my observation a case of the transportation of siliceous sand upon the surface of the water, due to capillary floating.

It is well known that a needle can be placed gently upon the water so as to float, the force of capillary attraction producing a surface tension so as to prevent its sinking. This same principle was being used in removing sand from a bar jutting out from an island in the Connecticut River.

The erosion was being carried on from the side of the bar against which the current did not strike. It took place by gentle ripple waves splashing up against the sand bar (which was at an angle of about 150° to the surface of the water) and upon the retiring of each wave a little float of sand would be on the water. At first these were about the size of a silver quarter of a dollar, but by the union of a number, some floats would be formed of about six inches square. These blotches were so numerous as to be very noticeable in rowing up the river, and could be traced for half a mile or more below the bank, though this bank from which the sand came was but a few yards long.

If one of the blotches was disturbed by touching or the too violent action of the waves, it would immediately separate, the particles at once falling to the river bottom. This shows that coarse sand *can be* floated away by a current of far less velocity than 0·4545 mile per hour.

It shows a method of removing sand from the lower side of a forming bar which has got above high water mark.

It indicates a possible explanation of the coarser particles of sand occasionally found in otherwise very fine deposits.

Car Coupler Law of New York.

The following is the existing State law of New York concerning car couplers, passed in 1889:

"All persons and corporations operating any line or lines of railway by steam power in this State shall, after the first day of November, one thousand and eight hundred and ninety-two, equip all of their own engines and freight cars run and used in freight trains, or other trains in this State, with . . . automatic self-couplers; and it shall be unlawful after that date to run or operate in this State any freight cars belonging to such persons or corporations without having the same equipped with the appliance above mentioned. Provided, that it shall be lawful, in case of accident or other emergency, to temporarily dispense with the use of such appliances."

Correspondence.

A Whistling Well.

To the Editor of the Scientific American:

I have a six inch bored well in my door yard, 135 feet deep, with eight feet of water. Over a year ago I noticed that at times a strong current of air came out of the openings around the pump stock, and by observation find it to be an excellent barometer, as it blows from six to twenty hours preceding a storm. I have placed a brass whistle in the space, which at times can be heard a quarter of a mile. The harder and longer it blows, the more intense will the coming storm be. A peculiarity of it is the fact that, after the storm, it takes back the wind. It is not gas, as it has no smell. An immense volume of air passes out during one of its protracted blows. The air comes up through the water. When well is open, one can hear it bubbling.

It is called hereabouts "the whistling well." There are a few other wells within a mile or so of here that act in unison with it, but their owners have not as yet put whistles in them. The noise at times becomes so monotonous that we are compelled to plug it up. Can you give a scientific solution of the phenomenon?

To all who have as yet visited it, the source is a profound mystery. R. L. SMITH.

Winona, Logan County, Kan., December 15, 1890.

Ingrowing Toe Nails.

To the Editor of the Scientific American:

I have noticed in several of the late issues of your valued paper some methods of treatment of ingrowing toe nails. As I have had a number of cases to come under my notice in dispensary practice, probably the course of treatment that we pursued may be of interest to some of your readers. In all cases, and even in severe forms of ingrowing toe nails, where one would be disposed to think that the only procedure would be to remove a portion of the offending nail, together with the matrix or bed of the nail, we resorted to the simple method of packing the ingrowing portion of the nail with cotton. After the nail has been well packed, a few drops of the tincture of chloride of iron are allowed to soak into the cotton. The iron acts as an astringent, hardening the usually very tender and sensitive granulations; it also deadens pain to a great extent, and by its stimulating action causes healthy tissue to form rapidly. The packing is repeated three times weekly; and at the end of one or two weeks the use of the iron may be discontinued. The nail, however, is to be well packed with cotton until the ingrowing portion has grown out and is able to be properly trimmed. In trimming the nails one should be careful to cut them straight across and not to carry the scissors deep down into the corners of the nail, as so many are apt to do.

I have seen some of the worst cases of ingrowing toe nail cured by following the above plan of treatment.

CHARLES B. WILLIAMS,
Resident Physician, Pennsylvania Hospital, Phila.
Philadelphia, Dec. 17, 1890.

Improved Lamps Greatly Needed.

To the Editor of the Scientific American:

The Boston *Herald* publishes another lamp casualty, which occurred at Newark, N. Y., on the 19th December last, by which a woman and child were burnt to death.

The alarming frequency of such disasters imperatively demands some radical improvement in the present method of burning oil.

It is with the view of furthering this object that I wish to bring before your readers the results of experiments which I have recently made, in order to ascertain, as nearly as possible, the cause of similar accidents, commonly known as "lamp explosions."

From investigation I find that it has long been the aim of lamp manufacturers to keep the main body of the oil in the fount, or reservoir, as cool as possible, and there is no doubt that, by highly ingenious methods of construction, they have fully succeeded in attaining their object. There are, indeed some lamps, of the more expensive patterns, in which I find the increment in the temperature of the main body of the oil scarcely noticeable, after several hours' burning, yet I find these lamps as dangerous as the cheaper kind, for the simple reason that the space inside the fount, not occupied by oil, is quickly filled with explosive vapor, which is generated in the wick tube by the heat of the flame which rests thereon.

This device attains a high temperature after the lamp has been burning but a few minutes, and consequently an explosive vapor is rapidly generated therein, which descends into the fount containing the oil. There it collects, ready to catch fire, and explode, although the oil beneath is perfectly cool.

This action can readily be proved by a comparatively simple experiment. Take a wick about four inches wide, moderately saturate it with kerosene oil, place it between two plates of common window glass, ignite the top of the wick, and to prevent smoke, have as little as possible of the wick above the wick tube. Then hold the device over a hot stove or other heated surface. Soon a vapor, generated in the tube on which the flame rests, may be observed descending and issuing from the lower end of the tube. This vapor is highly explosive, and may instantly flash into flame.

It is obvious that the action, above described, is quite independent of the temperature of the oil in the fount, which may be, for the sake of experiment, as low as 32° Fah., or the freezing point of water!

I hope that my suggestions may lead to improvement in the present defective method of using oil.

PROFESSOR.

Smokeless Powder.

From the following interesting report of Krupp even laymen can form a judgment as to the high value of the smokeless powder. The report reads as follows:

Much as has been written so far about the effects of the new powder, no side has touched upon the composition of its chemical component parts. A much wished for light is thrown on this composition for the first time by the trial shooting report of Krupp. We have taken from it, says *Kuhlow*, the following, which is of general interest. For all new kinds of powder nitrited cotton forms the basis. If cotton is treated with nitric acid and sulphuric acid, then, according to the strength of the acid and the methods employed, three kinds of nitrated cotton arise:

	Trinitro-Cellulose.	Binitro-Cellulose.	Mononitro-Cellulose.	Cellulose.
Carbon	24·24	28·57	31·80	44·45
Hydrogen	2·36	3·18	4·34	6·17
Oxygen	59·26	57·14	54·10	49·38
Nitrogen	14·14	11·11	6·76	....
	100·00	100·00	100·00	100·00

So far it has not always been possible for one to prepare with certainty the one or the other combination of nitrogen mentioned above. On the contrary, the different combinations are always found to be mixed. If trinitro-cellulose preponderates, the product is called gun cotton; if binitro-cellulose preponderates, we get collodion wool. Gun cotton is only soluble in acetone, collodion wool only in spirit of wine and nitro-glycerine. This latter property has been utilized by Herr Alfred Nobel, the inventor of the dynamite, to manufacture a new powder for guns and cannons. The gun powder proposed by Nobel is made of equal parts of collodion wool and nitro-glycerine. The preparation is made in the following manner: At a temperature of +6–8° C. one part of collodion wool is put into 6–8 parts of nitro-glycerine. The whole is taken into a place which can be made void of air, so that the nitro-glycerine can come into the closet contact with the wool, then the nitro-glycerine substance is—as far as it is necessary for the intended mixing proportion—pressed out under a press or in a centrifugal pump. The cake which is gained by this flinging out or pressing is broken into pieces, exposed to a temperature of 60–90° C., in which the nitro-glycerine dissolves the collodion wool. Then the mass is rolled, under the same high temperature, into thin plates. These thin plates are pressed into thicker ones under a roller. The product thus gained must be perfectly homogeneous and evenly translucent in all parts. The thickness of the plates depends on the largeness of the required powder. The powder is used in the form of dice or in that of plates. To secure the stability of this powder one may add to the glycerine at the beginning half per cent diphenylamine. So much about the old manufacture.

The new chemical formula would be:

$$10C_3H_5(ONO_2)+9C_6H_7O_2OH(ONO_2)_2$$

with a molecular weight of 4,538. The decomposed products would therefore be:

$$58CO + 26CO_3 + 61H_2O + 48N$$

and all gaseous. The powder can be styled therefore smokeless, because the small amount of ash which the wool contains remains unnoticed. The products of combustion become visible by the steam getting condensed, when leaving the inside of the gun, and the nitrogen entering into a chemical combination with the oxygen of the air. What we see, during the firing, is therefore not powder smoke but powder steam, which disappears quickly if the charge is small. The powder has a density of 1·6, its color is yellowish, it feels to the touch like elastic and can be easily cut with a knife; it is not sensitive to moisture, and less sensitive to changes of temperature than the old powder; to warmth it is rather more so. That it is not advisable to keep powder at a temperature of more than 50° C. experiences with the black powder have shown. All the statements made here have been laid down by Krupp after a number of the minutest trials, and they are all indubitably true. We may only add that this firm had used for one year and a quarter smokeless powder for all calibers.

THE Royal edition of the *N. W. Architect* is an elegant production. It is embellished with a number of superior photographic prints of new buildings of beautiful architectural design.

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INTERESTING OPTICAL ILLUSIONS.

BY GEO. M. HOPKINS.

One is five. Two are ten. Straight is crooked. Motion is quiet. These are strange and apparently contradictory statements; but if we are to rely entirely upon the evidence of our visual organs, they are true. Human visual apparatus has certain qualities which cannot be classed among defects, although under certain conditions they prevent seeing things as they really are. To persistence of vision, or the property of the retinal nerves by which an image is retained after the object by which it was formed has disappeared, are due the phenomena here described and illustrated.

A short time since the writer, in search of new optical illusions wherewith to amuse if not to instruct a little company of scientific persons, found in the store of the well known optician, Mr. T. H. McAllister, of this city, an instrument known as the anorthoscope, which was imported by him about thirty years ago. Although it was a novelty then, and probably well known to many, it is now rare. In fact, perhaps not one in the two or three hundred who have seen it had ever even heard of it.

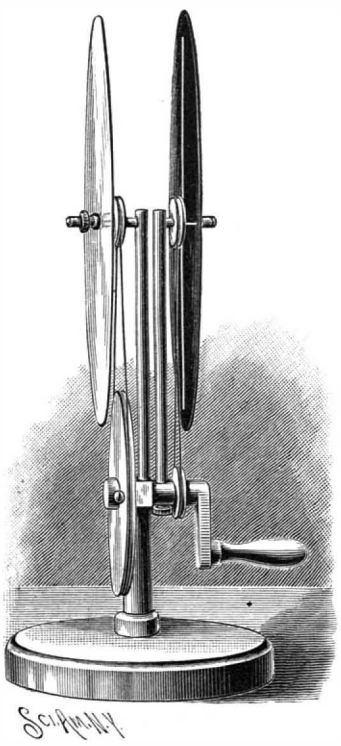


Fig. 1.—THE ANORTHOSCOPE.

The anorthoscope shown in Fig. 1 is a modified form of the instrument above referred to, and is adapted to experiments other than those belonging to the original apparatus. This instrument has a standard provided with a sleeve upon which is pivoted a movable arm. In the upper end of the standard and free end of the movable arm are inserted studs upon which are placed sleeves, each furnished with a pair of collars for clamping the paper disks—presently to be described—also a grooved pulley.

In the sleeve in the standard is journaled a shaft having at one end a crank, and a pulley of the same size as that above it at the upper end of the standard, and upon the other end a grooved wheel four times the diameter of the grooved pulley at the upper end of the movable arm. The small pulley below is connected with the small pulley above by a crossed belt, and the large grooved pulley is connected with the small pulley above it by a "straight" belt.

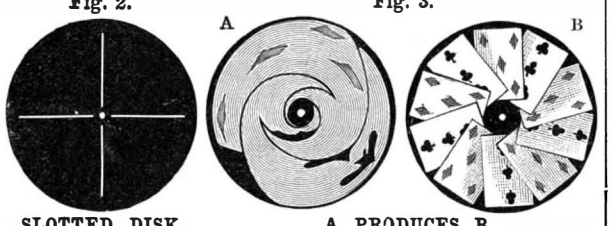
Between the collars upon the sleeve driven by the crossed belt is placed a black disk having four equidistant radial slots, and upon the other sleeve is secured a translucent disk bearing an anamorphosed design which, viewed separately from the instrument, bears little resemblance to the object it is intended to represent, but when revolved in the anorthoscope and viewed through the slots of the black disk, the enormous distortion is corrected and five correct images are seen. This number of images is accounted for by the four revolutions in one direction of the disk carrying the design and the single revolution of the disk with radial slots in opposite direction, giving five views of the same object for every revolution of the radially slotted disk. The designs are distorted only in the direction of their rotation, the proportions in the direction of the radii of the disk being normal. A face view of the radially slotted disk is given in Fig. 2.

In Fig. 3 the distorted card design shown at A is seen in the anorthoscope as a hand of cards as shown at B. In Fig. 4 the design, C, produces the wreath, D, in the instrument, and in Fig. 5 the distorted flowers, E, produce the wreath, F. The distorted image is seen only in narrow successive sections, which by the retaining power of the retinal nerves are blended into an image which is shortened in the direction of rotation to one-fifth its real dimensions, while it is multiplied five times.

There are two methods of laying out the designs for this instrument, both based upon the development of the original picture in a subdivided rectangle. It is obvious that if a subdivided square can be produced in the anorthoscope from a distorted representation of it, any figure that can be inscribed in such a square can also be produced in the same way. In Fig. 6 is illustrated a method of laying out a rectangular parallelogram, A, divided into thirty-two equal squares, alternate squares of the upper two rows being shaded.

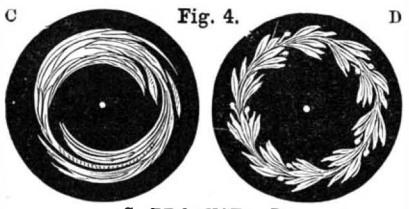
To lay out the figure, from the center C, strike a circle bounding the periphery of the disk, draw a diametrical line, and at any convenient distance from the peripheral line lay out the rectangular parallelogram, as shown. From the center, C, describe an arc, touching the outer angles of the parallelogram, A; locate a new center, D, below C, on the diametrical line, a distance equal to the versed sine of this arc. From this center describe circles tangent to the horizontal lines of the subdivided rectangular parallelogram. Lay off on the central circle spaces five times greater than and equal in number to the longitudinal divisions of the parallelogram. From a point at the intersection of the diametrical line with the middle circle of the set thus drawn, draw lines intersecting the middle circle at the points set off. These lines radiating from the point, *a*, and the eccentric series of concentric circles bound spaces which appear as squares in the anorthoscope. The lines radiating from the point, *a*, must be increased five times in thickness to secure a line of normal width in the instrument. The spaces in the distorted figure representing the shaded squares are filled up solid with black, the whole forming the figure B, which, viewed in the anorthoscope, appears as at A. Any figure drawn on the subdivided parallelogram and projected on the distorted figure, B, would appear normal in the instrument.

Fig. 2. Fig. 3.



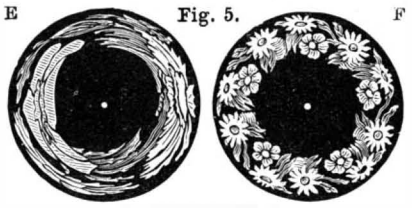
SLOTTED DISK. A PRODUCES B.

Fig. 4.



C PRODUCES D.

Fig. 5.



E PRODUCES F.

When accuracy is immaterial, the figure may be developed on circular lines, as shown in Fig. 7, the horizontal spaces of the square, A, being developed on the circular lines by radial lines which intersect the middle circular line at equidistant points separated by spaces, each having five times the width of one of the smaller squares. The distorted figure, B, viewed in the anorthoscope, appears very nearly like the outline drawing of the flower in the square, A. In this diagram everything is drawn with reference to the center, C.

Recently the writer has adapted these experiments to the lantern. The distorted pictures, which are drawn on cardboard disks about thirty inches in diameter, are placed on a large rotator about twenty-five feet from the lantern, and in the lantern slide holder is placed the rotary disk shown in Fig. 8. This disk, which is provided with four narrow radial slots, is mounted on a small stud projecting from a plate of glass held by the frame of the apparatus. The slots are extended as nearly as possible to the center of the disk, and the segments of the disk are strengthened by triangular braces.

To avoid using a belt, the disk is driven from its periphery by rubber frictional gearing, as shown. A lantern objective of low power is used and the slots are sharply focused on the large disk. The disks are arranged with their axes in line, and when the revolutions of the smaller and larger disks are as one to four, and in opposite directions, the effects above described are produced on a scale sufficiently extended to be seen by a large number of spectators. In this experiment the axes of the disks must be in line.

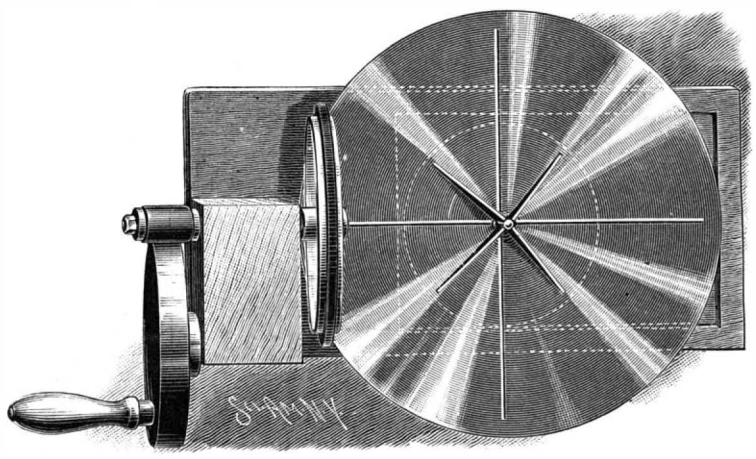


Fig. 8.—ROTARY DISK FOR THE LANTERN.

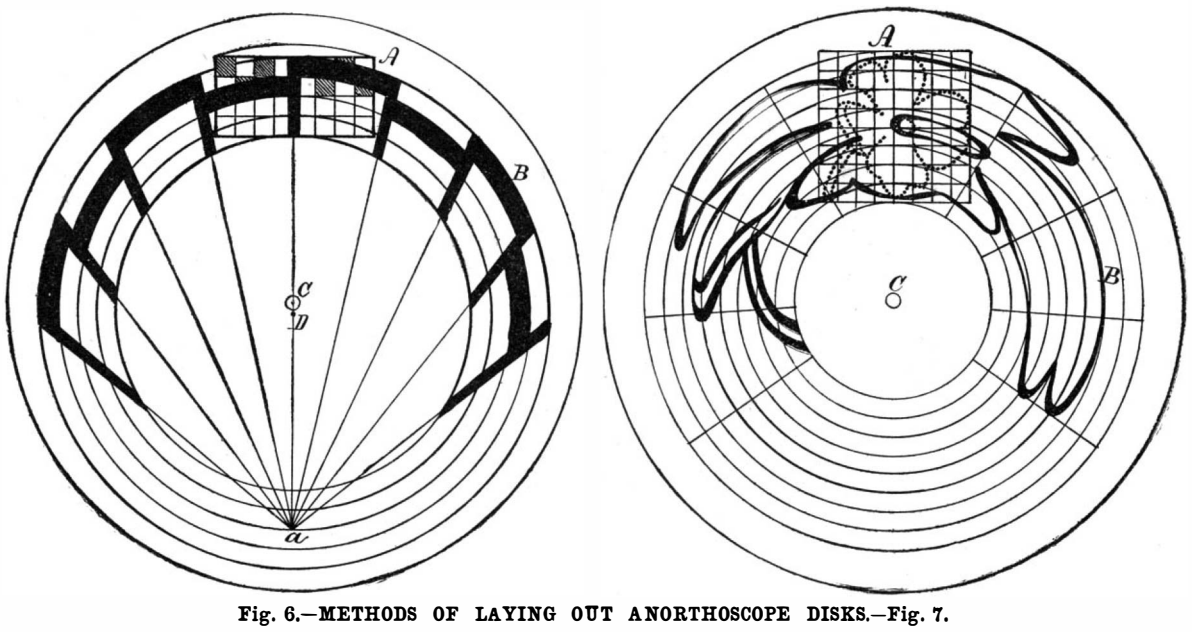


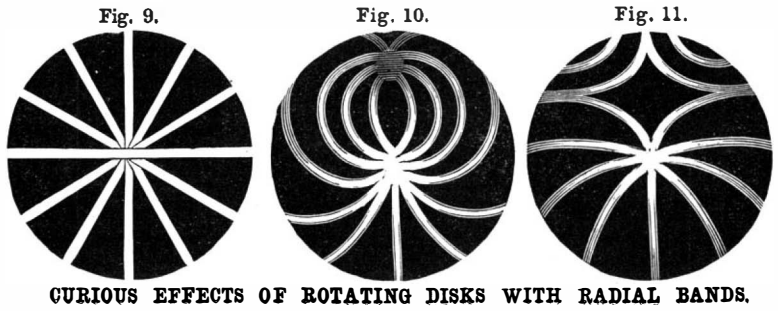
Fig. 6.—METHODS OF LAYING OUT ANORTHOSCOPE DISKS.—Fig. 7.

By substituting the disk shown in Fig. 9 for the anorthoscope disk some very curious effects may be produced. When the axes of the disks are in line, the radial bands will be apparently multiplied or reduced in number according to the relative speeds and the direction of rotation of the disks. When the radially slotted disk in the lantern is arranged eccentrically with reference to the large disk having radial bands, the effect shown in Fig. 10 is produced when both disks are rotated in the same direction, and when they are rotated in opposite directions the effect is as shown in Fig. 11. These forms may be greatly modified by moving the slotted disk in the lantern across the field.

These curious effects are due to the crossing of the white radial bands by the bands of light from the lantern and the retention of the images of these spots of light throughout their entire course, thus giving the appearance of curved bands.

By substituting a disk with radial bands for the anorthoscope disk in the instrument shown in Fig. 1, and swinging the movable arm of the instrument over, so as to arrange the disks eccentrically with reference to each other, the effects last described may be viewed without the use of a lantern.

Fig. 9. Fig. 10. Fig. 11.



CURIOUS EFFECTS OF ROTATING DISKS WITH RADIAL BANDS.

A RUBBER layer sandwiched in the sole of the shoe is said to prevent wet feet.

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THE SIGN LANGUAGE OF THE AMERICAN INDIANS.

The language of signs is the only universal language, and it is the oldest language, says *The Illustrated Christian Weekly,* to which we are indebted for the accompanying engraving and article. It is by signs that the brutes converse. Monkeys talk with their hands and legs, and even insects talk with their antennæ. The child speaks at first by gesture, though the gesture language is discouraged, and the limbs are put aside for the tongue. But just as we have to converse with a little child by signs, so we have to talk to the insane, who often have no knowledge of words. And signs are still used by the sane. When we pray we use our clasped hands as a sign of appeal, or bow the head in sign of reverence or adoration; and when we welcome a friend we clasp hands in token of welcome. In fact, try as we will, we cannot yet dispense with the gesture language.

At Washington, on March 6, 1880, seven Ute Indians who were proficient in the sign language were introduced to seven deaf mutes, and conversed with them. The experiment was entirely successful. They told each other stories, and the stories were written down and examined, and found to agree in every particular.

The Indians are the best sign talkers in the world. The multiplicity of their dialects rendered some general means of communication inevitable among them, and though legend assigns the invention of the sign language of the plains to the Kaioways, we shall not be far wrong in assuming that it is much older than the division of the Indian race into its minor tribes. This language, to which we propose to devote some attention, is curiously complete. By it one Indian can converse with another from Alaska to Panama. It has its general signs, its conversational signs, and its tribal signs. Let us take the general signs first.

The blanket is often used for signaling. When the Omahas discover buffalo, the blanket is held out at length, with the hands as far apart as can be. When it is intended to camp, the blanket is raised aloft on a pole. When a signal is made to approach, the lower edge of the robe or blanket is waved inward to the legs. The signal of the discovery of enemies, game, or anything else is to ride round and round in a circle, passing and repassing each other if there is danger.

If at any time it becomes necessary to communicate with friends at a distance, smoke signals or dust signals are used, so many pillars at different intervals apart signifying certain warnings or encouragements. At night a most remarkable system of signaling by means of arrows of fire is in use. The arrows are wrapped with tow round their heads, the tow is dipped in some resinous matter and lighted, and the blazing messenger is then shot aloft, to be visible over a wide extent of country, and by many to be mistaken for a meteor.

But it is with the conversational signs that most interest lies. Over and over again furs have been sold, leases granted, and treaties made in the far West without a word being spoken between the parties. The Indian interpreters employed by the United States government are all proficient in this wonderful universal language; and, though it varies in different districts, yet its meaning is always unmistakable. Some of the gestures used are strangely eloquent.

Take bad, for instance. The general sign for this is to scatter the right-hand fingers outward, as if spurting away water from them. But among the Arapahoes the fingers of the right hand are half closed, the thumb is hooked over the fore and middle fingers, the hand is moved back upward a foot or so toward the object referred to, and then the fingers are scattered, so as to show that the object is only worth throwing away.

Brave is shown among the Shoshones by clenching the right fist, and placing it on the breast. But among the Sioux the two fists are pushed forward about a foot at the height of the breast, with the palms inward, the right being about two inches behind the left. Among the Comanches and Kaioways the sign is that given in the illustration.

Dead is shown by throwing the forefinger from the perpendicular into a horizontal position toward the earth, with the back downward, or else by crossing the arms on the chest and then letting them drop at the same time on the head. The Bannack sign is that we give, which is also in use among the Shoshones. For dying we give the sign common to the Apaches, Comanches, and Kaioways. For "nearly dying, but recovered," the Kaioways have a most significant gesture. The hand is moved slowly downward, and then upward again.

Grow has another eloquent sign, the hand being held as in the illustration, and moved upward in an interrupted manner. Much the same sort of sign is used for smoke, but in that the hand is thrown upward several times from the same place instead of continuing the whole motion upward.

For None, Nothing, or I Have None, a very expressive sign is used among the Sioux. The palm of the flat right hand is passed over the left from the wrist toward and off the tips of the fingers. With a little modification this sign is used among the Kaioways, Comanches and Apaches.

For Friend, we give the Dakota sign. It is worthy of note that an Indian rarely shakes hands with Indians; that is a ceremony he reserves for his pale-face friend.

For Killed, the Cheyenne sign is given.

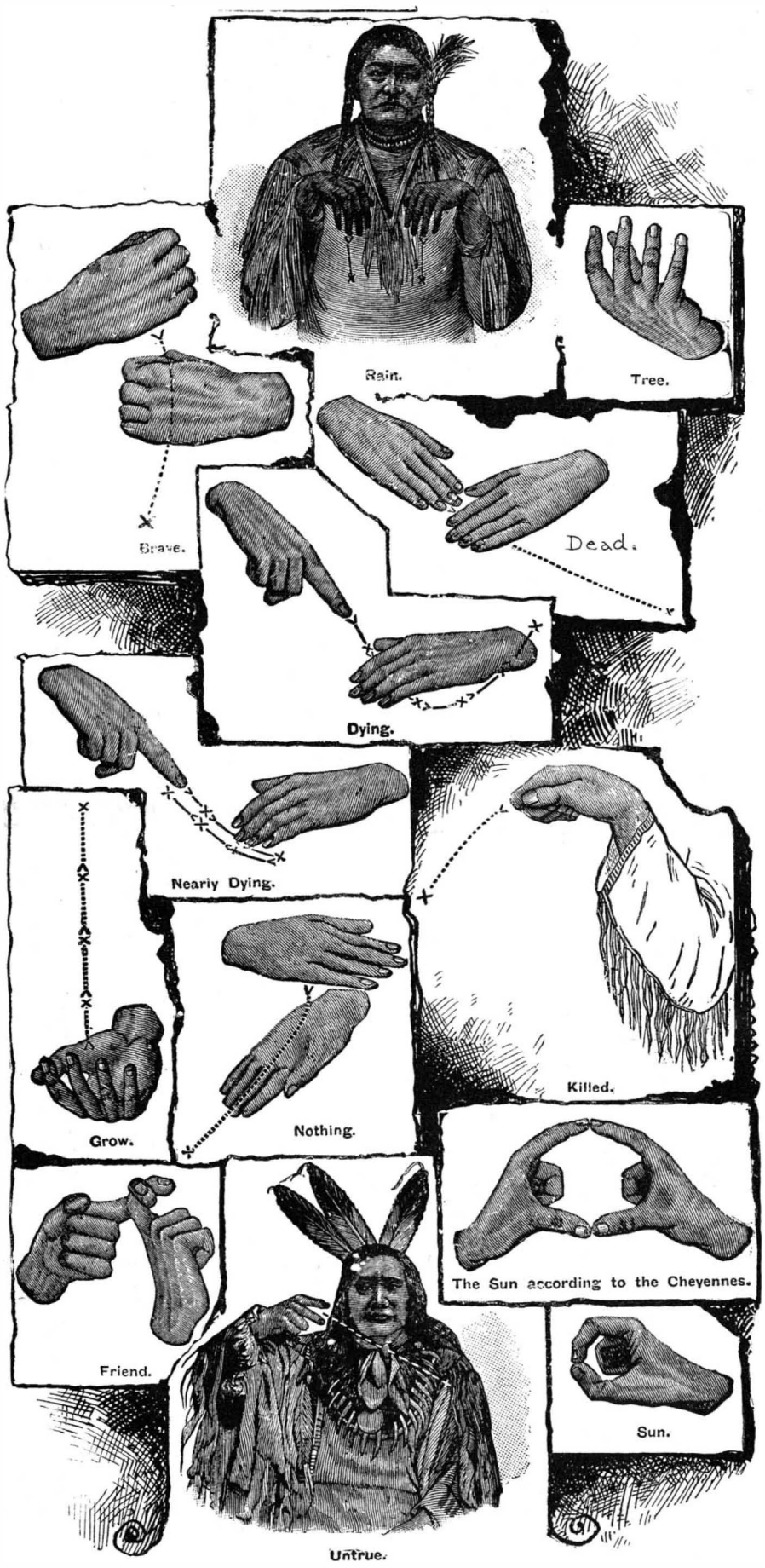
Rain is denoted by the Shoshones and Apaches by apparently dripping fingers.

We give the ordinary Sun and the Cheyenne Sun. Both mean the same, the completeness of the disk being shown in each case.

Tree is given according to the Dakotas, the right hand being held before the body, as shown, and pushed slightly upward, to give the idea of growth.

Untrue. The Arikara emblem of a falsehood is significant, the first and second fingers being moved in the direction of the dotted line.

The American Indians are the most stolid of races. We hear of them times and again sitting for hours without moving a muscle, and yet among them the language of pantomime flourishes at its fullest. It is much the same with them as it is with the Italians. As a nation of gesticulators, we should class the Italians far below the French, but owing to their peculiar divisions it has been found indispensable to have one general language, and to keep it at a fair average of cultivation. A most striking example of the perfection to which sign language can be brought forced itself into history in 1282. In that year the Sicilian Vespers rebellion was arranged throughout the island, and even the day and hour fixed, without a word being spoken or written. Every detail of the conspiracy was commanded by gesture.



SIGN LANGUAGE OF THE AMERICAN INDIANS.

Wooden Water Pipes.

The *Olympia Capital* describes the method of manufacture as follows:

A large pile of bright yellow wooden pipe was in one place, near by another pile of similar pipe, but with narrow steel bands coiled around them, like spiral springs, and another pile covered, consisting of pipe covered with asphaltum. These were in the different stages of manufacture. Inside the factory the green logs, as brought from the forest, are drawn up from the Sound and cut into lengths of eight feet. These are rolled to the boring machine. This consists of a hollow auger eight feet long. The log is securely fastened on a carriage, and the machinery set in motion. The rapidly revolving auger bores into the heart of the log, and in time appears at the other end. It has fairly eaten a hole clear through it. The core of the log is in the hollow of the auger, and when removed is in turn bored and made into pipe of a smaller size. When taken from this machine the inside of the pipe is complete, but the exterior, covered with knots and bark, is the same as when taken from the forest. The next process is to remove this bark. For this purpose a great turning lathe is used. The log is made to revolve at a rapid rate, and a chisel securely fastened to a carriage slowly moves along, bearing away the bark and fiber. Backward and forward the chisel moves, and at each trip more fiber is torn away and the pipe grows thinner. When all but one inch of the wood is removed, it begins to show what it is intended for. The next process is to chisel the ends for an iron collar that serves to join the pipes when used. After the ends are cut down to the proper size, the pipes are placed in a dry kiln and seasoned. The next process is the wrapping. A pipe is placed in a machine similar to the turning lathe. A steel strap about two inches wide is fastened to one end, then the pipe slowly revolves, and the strap is wound around in a spiral form the entire length and fastened at the other end. After that a coat of asphaltum is applied, and the pipe is ready for market.

The first of these wooden pipes were made so one would fit into another. Now a steel collar is used, and when the pipes are fitted into it there is but half an inch between them, and the collar fits so tight that no water can escape.

The capital stock of the company is $50,000 and the profits of the factory for this year will be more than the capital stock. Over 500 miles of this pipe are now in use, in sizes from 1 to 12 inches, by water works companies, in mines, and for all kinds of conduits throughout the Northwest. Last year 200 miles of this pipe were made. If the company decides to remain in Olympia, the capacity will be increased to four times the present output, and new buildings will be erected. The company is now simply awaiting the action of the railroads coming to this city.

THE pitting of small-pox has been entirely prevented by Dr. Lewintaner, of Constantinople (*Wien. Klin. Woch.*) by antiseptic treatment as follows: The entire head and face, except eyes, and the neck are covered with plaster consisting of 3 parts carbolic acid and 50 parts each of olive oil and starch. The body is covered over with a mixture of 3 parts salicylic acid, 30 parts starch, and 70 parts olive oil. The internal treatment consists in giving quinine in acid solution.

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New Sugar Items.

France.—Recent observations on the action of lime upon raffinose have brought to light some interesting facts; the combination that occurs without heat appears to be the only one existing; 100 parts raffinose absorb 10 parts lime. A solution of raffinose at 15° C. will absorb a quantity of lime depending upon the degree of concentration of the saccharine solution. This amount is about one-half of that absorbed by a saccharose solution of same concentration. The lime raffinosate is precipitated by alcohol, but is less soluble than saccharate of lime. Certain sugar compounds may be made to take up raffinose. If molasses (containing saccharose and raffinose) be saturated with lime and then a small quantity of alcohol be added, the calcic precipitate will be richer in raffinose than was the molasses. In this may consist a method of extracting raffinose from this refuse. As the precipitation is repeated the percentage of raffinose decreases.

With the idea of improving existing agricultural methods of beet alcohol rectification, prizes are to be offered during 1891. The product should be of an irreproachable quality, and chemical or mechanical means may be employed.

Efforts are being made to have a heavy custom duty placed on molasses. As matters now exist, this product very seriously competes with the agricultural interest of the country. If its importation diminishes, there would follow an increased area devoted to grain, etc., which would be subsequently used in distilleries. Molasses distillation gives as residuary products, potassic and sodic salts. On the other hand, grain or root utilization furnishes scum cake for the soil as a fertilizer and excellent food for cattle. The labor question is also important. It appears that a molasses distillery requires very few hands for its working, as compared with a beet distillery.

Statistical data relating to the use of sugar in wine and cider manufacture are interesting, as showing the importance of these industries. The total quantity of sugar used for such purpose during 1889 was 20,500,000 kilos., and the resulting product was 1,788,000 hectoliters wine and 65,600 hectoliters cider. The grape crop having been a partial failure that year, such methods of strengthening were, as usual, resorted to.

The proposed changes in the fiscal system are not proving satisfactory. The law of 1884 gave a stimulus to the beet sugar industry, and should be left as it now stands. As the selling price of refined sugar has decreased, the purchasing price of beets has increased. The number of factories working in France diminished from the time that sugar was taxed. During 1889–90 there were produced 680,000,000 kilos. sugar, 305,000,000 kilos. molasses, and 2,500,000,000 kilos. pulp. The latter was sold for $2,000,000. The total value of sugar, molasses, and pulp was $70,000,000, or $144 per acre of beets cultivated.

From the sugar manufactured, the government collected in taxes $33,000,000—taxes on alcohol, value of beet leaves, refuse from filter presses, carriage by rail, etc., are estimated at $8,000,000. The total $113,000,000 is the amount representing the yearly national fortune from the beet industry, or $200 for every acre of land cultivated in these special roots, of which about $80 is taken from the air and does not represent a loss to the soil, etc., but may continue indefinitely; the remaining $120 represents labor, commercial transactions, fertilizers, etc.

A new beet slicer gives cossettes in T-shape; the cutting blades have an irregular, zigzag shape. The advantage claimed is that the small beet slices will not adhere to each other, and thus prevent the osmotic action of the circulating liquid in the diffusers, a trouble now most frequently occurring.

A very important new sugar process has been recently discovered by MM. Vivien and Lefranc. It is called "Fluation." Most of the existing methods for heating saccharine juices depend upon lime, baryta, etc., for defecation. The calcic-carbonic acid process eliminates about 40 per cent of the organic substances a juice may contain. The mineral elements are but slightly affected. A juice having a saline coefficient of 26 and purity coefficient of 85 when treated by existing processes will have a S. C. of 30 and P. C. of 90. On the other hand, by the *fluation* method the P. C. becomes 95 to 96 (?) In this process a fluo-silicate of lead at 34° B. is used. The quantitiy must be calculated to correspond to the requirement of each special case. The lead solution in excess may be eliminated by the addition of a small quantity of lime. Mechanical filtration follows and the purification is then finished.

The last trace of lead may be eliminated in various ways. Juices direct from diffusion battery, when treated by this method, subsequently gave *masse cuite* of an excessive purity, and in vacuum pan a heavy yield of sugar. Attention is called to the economy of *fluation;* the purification being done when juices are cold, there is considerable saving in caloric, which saving is estimated at 15 per cent of total fuel required by customary methods. In the residuary products may be found phosphorus, potassa, etc., from which, also, may be regenerated the fluo-silicate originally used. It is said that this process cost nothing; on the contrary, it may be a source of revenue of about 20 cents per ton of beets worked.

An "ebullioscope" recently invented gives by simple reading on a graduated scale the percentage of alcohol contained in a solution.

In sugar analysis by polariscope it is admitted that a deviation of 100° of the *Laurent* apparatus corresponds to 16·19 grains of sugar in the solution under observation. Chemists of different countries assert that 16·26 grains, 16·30 grains, etc., are the correct figures to be used. All the recent determinations are higher than the original figure, as given by *Girard* and *Lynnes* fifteen years ago. The explanation appears to be that since these reports great improvements have been made in polariscopes, and their working leads to much more accurate results than formerly. A well known authority points out that 16·30 is as far from the truth as the original figure was. Flasks are now used of 100 c.c. capacity and are marked by weighing 100 grains of water in the air at 15° C.; and it is impossible to obtain the division 100 with this weight. As a result, both the manufacturers and the government have been the losers.

A simple calculation shows what a discrepancy of this kind means; *e. g.*, during a recent campaign there were worked 4,216,850,000 kilos. beets, from which were made 414,860,576 kilos. refined sugar, as determined by the coefficient 16·19. If 16·30 coefficient had been used as the calculation of this total, refined sugar would have been 417,688,000 kilos. The difference, 2,818,000 kilos., means less money in the manufacturer's pocket, owing to a surplus drawback he would otherwise have received. It is seriously suggested that the matter be scientifically investigated.

It is said that the average yield of sugar during past campaign was 10 25 kilos. beets worked. It is thought that the total refined sugar production for the year will be 690,000,000 kilos., the drawback amounting to about $15,000,000 on 190,000,000 kilos. sugar.

The total production of alcohol during 1889 was 224,596,300 liters. There are 2,876 places where alcohol is made; 331 of these establishments used molasses or beets. The industry is mainly in the hands of 46 distillers, who produce 63 per cent of all the product.

In the department of *Aisne* last year, there were destroyed nearly 600,000 kilos. of beetles. If we admit 1,200 beetles per kilo. and 20 eggs per beetle, this destruction represents 13,900,000,000 white worms. In many other parts of the country active measures in this same direction are being taken. Special trials have demonstrated beyond cavil that excellent results may be obtained by using benzine. This method, however, while efficacious, is too expensive for general use. Sulphide of carbon, when distributed on the surface of the soil, will saturate the same with its vapors, so that the white worm perishes in the strata below.

For some unknown reason, the residuary product from molasses distillation has undergone great changes in its composition. Five years ago 30 per cent of it was potassic carbonate, but now nearly 40 per cent; potassic chloride was then 18 per cent, and now 8 per cent; sodic carbonate in 1884 averaged 17 per cent, and in 1889 only 12 per cent. Chemists offer no explanation for these changes.

Refined sugars consumed in Tunis are imported from France and Austria-Hungary. Raw sugars have a very limited sale.—*The Sugar Beet.*

Prof. Ewing's Model of Magnetized Molecules.

Ever since the time of Ampere, physicists have been familiar with the idea that a magnetic substance consists of an assemblage of minute magnets. Prof. Ewing accepts and starts from Weber's theory that the molecules of iron and cognate substances are always magnets, and that the process of magnetizing consists in turning them from their many directions into one direction.

"Every one knows," says Dr. Oliver Lodge, "that when a substance is subjected to magnetizing processes, some of the magnetization excited is only temporary, while some continues permanently after the magnetizing forces are withdrawn—a fact which may be expressed by saying that the molecules are strained out of their old positions into new ones, and when released they spring back part way toward their old positions, but do not completely recover unless the strain has been very small or the iron excessively soft."

Prof. Ewing has built up a molecular model of the simplest kind, in order to show what really happens to the molecules in the successive stages of magnetization. The model consists of a large number of short steel bar magnets strongly magnetized, each pivoted upon a sharp vertical center, and balanced to swing horizontally. The bars swing with but little friction, and their pole strengths are sufficient to make the mutual forces quite mask the earth's directive force when they are set moderately near one another. The group is arranged on a board which slips into a large frame. The frame is wound around the top, bottom, and two sides with a coil, through which an adjustable current may be passed to expose the group to a nearly homogeneous external magnetic force. Little magnets furnished with air vanes illustrate capitally what has been called magnetic viscosity. When the imposed force reaches a critical value, some molecule swings round; the next neighbors finding their stability weakened follow suit, and the disturbance spreads through the group in a way eminently suggestive of the phenomena of time lag.

The scene when the current is passed into the molecular field is almost startling. The molecules do not arrange themselves with uniform polarity all in parallel lines or in closed chains. They fall into groups, each group forming a stable configuration in itself. Lines predominate, two or more of the molecular magnets linking themselves in one straight line, and others in lines parallel or not. Three magnets, for instance, give two in one straight line, the third in a line parallel to this. In a group of seven, three will be at right angles to the other four; in fact, in many groups this right-angled relationship is a condition of stability. Square patterns have a special interest, because iron and nickel crystallize into the cubic system.

The many experiments made with the model repeat on a visible scale the cycle of events which take place when the invisible molecules are magnetized in an ordinary mass of iron or steel, the process being traceable from the effects of even the smallest force up to that which produces saturation, and thence through the return series. All the known phenomena of hysteresis or retardation of effects behind the causes that produce them can be imitated by the model, as well as many others less obvious and familiar.—*Extract from "Science Notes," in the Leisure Hour.*

Mistakes of Architects.

In the search for the beautiful, the demand for impressive facades, the taste for complicated ornament, and a most singular appreciation of the odd, the grotesque, and the ugly, there is little attention paid to matters which seem self-evident and are of really vital importance. Windows are arranged to suit a symmetrical facade, whether they are just what are needed for the rooms or not, and even where it is possible, little attention is given to the direction of the sunlight in order that the living rooms may receive the full benefit of the natural warmth, nor are those rooms where it is not needed, or minor offices, relegated to the exposed side. The most important external feature, the door, is seldom adjusted to the climate.

Even in large office buildings, hotels, and churches, where there should be ample space for every structural convenience, the door is frequently of cramped dimensions, and instead of being preceded by a porch, which would be an integral part of the architecture, and which is absolutely essential in our long, cold, damp winters, is boarded up with "storm doors," that are not only hideous in design but an actual obstruction. With the rapid increase in the value of land which has taken place in all our large cities in late years, a wild fear lest any inch be wasted has resulted in a compactness of plan that is frequently painful. The housekeeper longs for the roomy closets and ample storerooms of the old buildings; the fine hall that once formed an imposing and appropriate entrance has given place to the narrow entry through which it is frequently impossible to carry the larger articles of furniture.

The same difficulty is experienced in the sharp, frequent turns which characterize so many stairways. Bedrooms are pushed into corners where they seldom have the benefit of pure, free air and the heat of the sun, for no other reason than that space is required for ample reception rooms and state apartments, which, though used comparatively seldom, are treated as the most important part of the house.—*The Telegram.*

The Width of Streets as Affecting Public Health.

According to an American contemporary, Dr. Anders has been making certain inquiries in Philadelphia as to the influence of the width of streets on the mortality from phthisis, and as the result of examining into the localization of 1,500 deaths he has arrived at the conclusion that the number of phthisis deaths is smaller in proportion to the population in wide streets than in narrow ones, and that in narrow streets the mortality is greatest where they are long or where they form culs-de-sac; in other words, complete movement of air about dwellings is a point of great importance in connection with the question of pulmonary phthisis. It is on this principle that all modern by-laws as to open space about houses are based, and it is as important to have wide open spaces behind houses as well as in the streets in front, so as to secure a proper through current of air. There is, as a rule, not much difficulty in getting a reasonable width of street in the case of newly laid out areas for building, but there is a constant tendency to put an undue limit on the needed area behind dwelling houses, although this is a matter of the first importance as regards the promotion of health and the prevention of a certain class of diseases. The observations from Philadelphia deserve the consideration of such sanitary authorities in this country as have not yet acquired proper control over the open spaces to be provided about new domestic buildings.—*Lancet.*

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Good Draughtsmen.

Draughtsmen worthy of the name seem to be a very scarce commodity in the engineering market just now, if the frequent applications of employers to this office can be taken as an index to the trouble they have in finding men to suit them, says the *Engineering News*. One bridge engineer said recently that out of eighty-odd answers to an advertisement for a bridge draughtsman, he did not find one that was worth employing. Even a satisfactory "tracer" is not easy to discover, as we know from our own experience. The trouble seems to be that too many so-called draughtsmen think that the art begins and ends in handling a drawing pen and in inking-in a pencil plan practically made by some one else. They are exceedingly limited in their knowledge of mechanics, and know little or nothing of structural details; in other words, they are neither well trained nor thorough in their work, and cannot be left to their own resources for a moment.

There was a time when imported German labor of this class met all demands, and usually met it well; but for some reason that we cannot explain the supply has lately fallen off, and the more valuable men already here are secure in permanent employ. The German technical schools devote much time to the thorough teaching of drawing as an essential adjunct of mechanical and civil engineering, and, as a rule, devote nearer twelve than four years to the careful training of pupils fitting themselves for these professions. While we would not encourage young men to adopt the drudgery of draughting for a life occupation, it is, nevertheless, one of the best schools for the mechanical engineer that can be chosen, provided that he goes at this work well trained in the principles and fundamental laws of mechanics, and always works with the combined purpose of making a good machine as well as a good drawing. The same remark applies to bridge draughtsmen and to those engaged in the design of metallic structures of all kinds.

In the time now allotted to "scientific training" in the majority of our technical school, probably all the time devoted to draughting is such as can be safely spared from other work. But in too many of our schools a little less time devoted to pure mathematics, depending practically upon a retentive memory for any future usefulness, and more time devoted to fundamental laws and to the training of the eye, the hand and the mind combined, would result in a graduate more useful than is usually the case to himself and to his employers. The young man leaving his school must necessarily be an assistant until he has had time to gather that worldly wisdom and experience that will alone fit him to successfully enact the role of a creator or leader. But the better and more thorough the previous training of the graduate, the better assistant will he make and the more rapid will be his advancement. It pays the student, therefore, to devote more time to his training, and pays in a proportion that altogether exceeds that of the extra years involved in this training.

Notwithstanding certain prejudices against this occupation, a really good draughtsman in the office of a bridge works or a machine shop, one who thoroughly understands his business in all its details, commands a much better salary than the average engineer on a railroad. And if he is an exceptionally experienced and good man, with individual push well developed, more doors are probably open to his substantial advance than is the case with an equally good man on railroad work. In any event, at the present time there is an army of idle men who call themselves draughtsmen, and will work for $60 to $75 per month, while the really well paid higher positions go begging for the lack of some one to fill them.—*Tradesman.*

Pambutano, a Substitute for Quinine.

Dujardin-Beaumetz has, according to the *Medical Press and Circular*, recently called attention to the antiperiodic properties of an extract obtained from the root of a shrub called pambutano. The aqueous decoction of the root has been largely and successfully used in the treatment of malarial fevers, it has been beneficial in a number of cases in which the symptoms did not yield to quinine. The isolation of an alkaloid has not hitherto been effected, but the plant contains various fatty bodies and essential oils in addition to a special kind of tannin. All the active properties of the root are extracted by maceration in alcohol at 60°. The writer in the *Press and Circular* adds that, while the high value of quinine as a febrifuge and antiperiodic is incontestable, the faults and failures of the old favorite do declare themselves from time to time, and hence the discovery of other vegetable products which have similar powers is not without importance, since some of these may and do succeed when quinine has proved ineffectual.—*N. Y. Med. Jour.*

THAT acid phosphate quickly attacks the teeth is an observation recorded by Dr. Head, D.D.L., in *Int. Dental Journal.*

THE MAGNETIC MAGNIFYING GLASS AND THE BOX OF NUMBERS.

Should we want a new proof of the saying, *Nihil novi sub sole*, we might find it in the magnetic magnifying glass, of which we here reproduce two very distinct forms, one of them dating back at least a century, since we find a detailed description of it in a work published in 1786.

The magnetic magnifying glass is the first of the magnetic recreations described by the author, Mr. Guyot, of the Literary and Military Society of Besançon. To describe the old apparatus is also to describe the modern one, and we cannot do better than to pass our pen over to the writer of the last century.

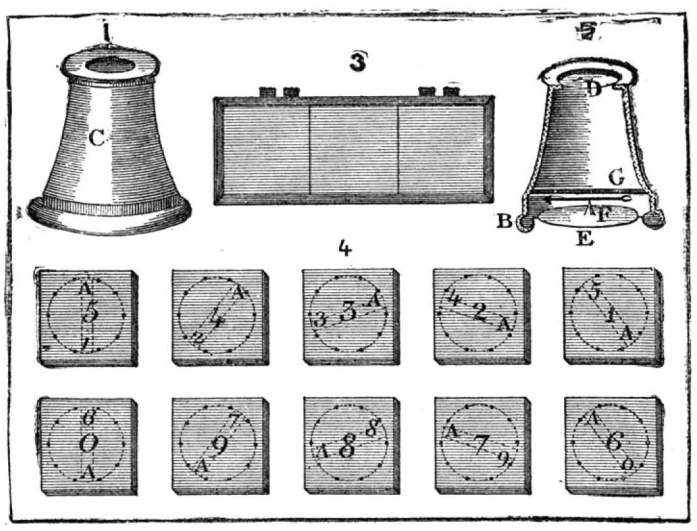

Fig. 1.—GUYOT'S MAGNETIC MAGNIFYING GLASS.

Nos. 1 and 2. The instrument. 3. Cover of the box. 4. Arrangement of the magnets.

"Have an ivory tube turned so thin that the light can pass into the interior of it. Give it a height of about two and one-half inches, and let it be nearly of the form shown in Fig. 1. Let the top, A, and the bottom, B, be screwed into this translucent tube, C. Let there be at the top of this tube a groove for the reception of a lens or ocular, D, whose focus is two inches. Let the ivory circle, B, be open in order that there may be placed therein a glass, E, that you will cover within with black paper and a small circle of cardboard. Put a pivot, F, in the center of this circle, and place thereon a very small magnetized needle, G, that is to say, a little smaller than the diameter of the circle. Cover the latter with a glass, so as to secure the needle and prevent it from leaving the top of its pivot. Finally, let this arrangement be a sort of compass placed at the bottom of an ivory tube translucent enough to allow the direction of its needle to be perceived, and the eye piece of which serves the better to distinguish the letters or figures that are to be drawn upon the cardboard disk at the bottom of this magnifying glass. Let it have, moreover, such a form as to give this compass the appearance of an ordinary magnifying glass, and make one imagine that he perceives by means of it the objects hidden and inclosed secretly in different boxes, as will be explained in the course of this work.

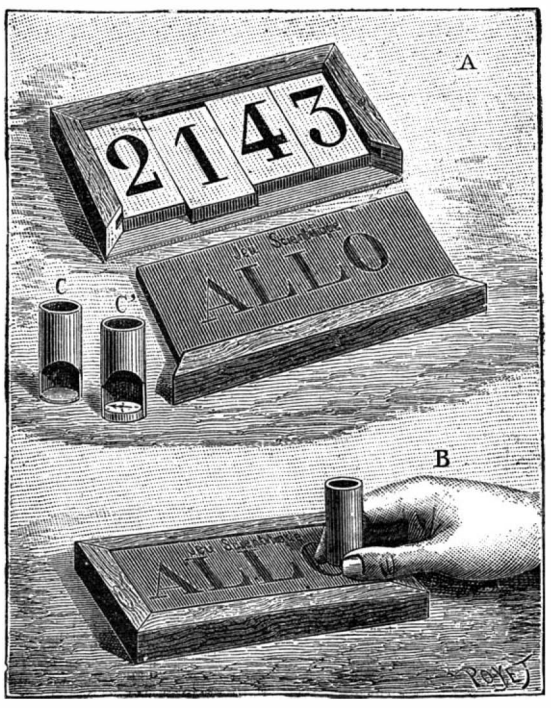

Fig. 2.—THE NEW FORM OF THE APPARATUS.

"When this magnifying glass is placed at a small distance above a magnetized bar or any box in which the piece that contains the bar is hidden, the magnetized needle contained therein will necessarily place itself in the same direction as this bar, and will, consequently, indicate which side is its north or its south. The north of the needle will indicate the south of the bar. . . . It is necessary to observe that the bar should not be too distant from the needle, particularly if it is very small, and that the pivot of the needle must be placed over the center of the bar, without which its indication might be erroneous, especially when in the pieces there are several bars that may act in unison upon the needle."

After thus describing the construction and effect of the magnetic magnifying glass, Mr. Guyot passes in review the different experiments that it permits of, beginning with the box of numbers represented in facsimile in Fig. 1. This box is capable of receiving three blocks selected from among a collection of ten, upon which are inscribed the first nine numbers and the zero, thus permitting of writing a great many numbers of three ciphers. In the interior of each of these wooden blocks there is concealed a small magnet, the position of which differs in each block, as shown in Fig. 1 (No. 4). After marking the corresponding numbers on the bottom of the compass once for all, it suffices to place the magnifying glass successively over the centers of the three squares which indicate the place of the three numbers concealed in the box (in which they have been previously arranged in secret), in order to know each of them and to rapidly read through the cover the number formed.

Fig. 2 represents the modern form given to Mr. Guyot's device. The experiment is made by means of four rectangular blocks, the place of the magnets that they contain being indicated by the four letters of the word ALLO printed upon the cover. In lieu of a magnifying glass, two small cardboard tubes are used, one of which, C (the only one offered to the novice) is a simple cylinder closed at one end, for which the experimenter always substitutes another tube, C', of identical appearance and containing the indicating magnetizing needle.

Mr. Guyot describes no less than forty-six scientific experiments that are made for the most part with the magnifying glass and magnets. Our perspicacious readers will have no trouble in increasing the number of them, by taking advantage of the well known properties of magnets and the laws of magnetic action.—*La Nature.*

Beef Extract.

We may, for convenience, divide the factory into three departments: First, pressing; second, bottling; and third, finishing. To the first of these, supplies of the choicest parts of the ox are brought in the morning of every working day straight from the shambles. It is at once cut up into succulent steaks, each of which get a slight sprinkling of table salt, is then inclosed in a new muslin bag and an outer canvas bag, and with dozens more is placed between the perforated metallic plate of an hydraulic press. When the company commenced work, they were content with a press which took a charge of about 100 steaks at a time, but they have had to meet a greater consumption than was anticipated, so that lately they have installed an exceedingly powerful press, which would do perfectly for making bales of cotton, and this is tested to give a pressure of 400 tons. When the pile of steaks is put on the receiver, the whole is surrounded with a jacket (iced in the summer), and the pressure applied. We need not follow the process too minutely; it is so simple. The juice as it is collected is mixed with an innocuous preservative, set aside for a month to clear, and then transferred to the bottling department. Here the liquor is filled into bottles by a siphon arrangement, so that the liquid comes into contact with as little air as possible; and the bottles when filled are transferred to a separate building, where they are corked, capsuled, labeled, and boxed. Our traveler observed that a girl examined each bottle before it was passed on to the capsuler, and any one which showed a speck of suspended matter, or was in the least cloudy, was set aside. It was explained that this is part of the principle of the manufacture; the liquor is the pure juice of beef, and in order that it may keep, the most rigid attention must be given to exclude foreign matter from it, and, as far as our representative could judge, the principle was adhered to throughout. And what becomes of the pressed steaks? Well, they are like cardboard when they come out of the press, and as dry as a stick.—*Chem. and Drug.*

Powerful Hopper Dredger for the Nicaragua Canal.

There was recently launched at Renfrew, complete, with steam up, a powerful screw propelling hopper dredger built and engined by Wm. Simons & Co., for the Nicaraguan Canal Construction Company under the direction of Chief Engineer A. G. Menocal.

This vessel has a capacity to carry 400 tons of dredgings, and will load itself with ordinary material in an hour. The bucket ladder, which works in a central well, is fitted with an endless chain of steel buckets and adapted to dredge banks and shoals to a depth of 35 feet under water level. The hull is constructed with the builders' patent raised forecastle, which permits the buckets to dredge in advance of the hull.

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RECENTLY PATENTED INVENTIONS.

Electrical.

DYNAMO ELECTRIC MACHINE.—Charles P. Scheuritzel and John L. Hess, Brooklyn, N. Y. According to this invention, the armature is formed of coils of equal length made separately and applied to the armature to overlap each other and form a regular series around the armature core, there being a novel arrangement of commutator brushes, whereby the current may be given from the coils singly in succession or from two or more coils in parallel, and the generator and motor being operated upon an open or closed circuit plan.

Mechanical.

CAN MAKING MACHINE. — Mathias Jensen, Astoria, Oregon. This invention covers improvements on formerly patented machinery for similar purposes by the same inventor, to increase capacity and insure certainty in capping and crimping cans after they are filled, without spilling the contents, the invention covering various novel features and combinations of parts.

HORSESHOE HAMMER. — George T. Peters, Butte City, Montana. The face of this hammer has two sides extending at an obtuse angle and both having a roughened surface, the apex of the face being flattened and left blank, making a hammer specially adapted for quickly and conveniently sharpening calks and toes for horseshoes, and fitted for use from either side of the anvil.

TOOL FOR POINTING MASONRY.—Jesse A. Blanchard, Duluth, Minn. This tool has two opposed plates loosely connected, between one edge of which the wedge-shaped member of a handle is adapted to enter, a heart being inserted at the opposite edge, making a tool especially adapted for masons' and bricklayers' use, and which may be employed to face the mortar between the courses as desired.

BOOK-LETTERING MACHINE.—George H. Reynolds, New York City. Mounted on the frame is a vertically reciprocating head block, with a central slot and front and rear guide ribs, pallet-carrying loops engaging the ribs, and other novel features, forming a machine designed to facilitate book finishers' work.

Agricultural.

SEED DROPPER. — Albert J. Helvern and William B. Schwalm, Walton, Ind. Combined with the seed drop bar, lever, and actuating mechanism, is an endless chain belt, an adjustable weight connected with the lever, friction rollers carried by the belt engaging the weight, making an attachment for planters with which is connected a marking device to effectually check the rows.

SAFETY CLEVIS. — James F. Forrest, Poynette, Wis. This device has two members, of which one is pivotally connected by an ordinary clevis with the end of the plow beam, and the other to the whiffletree to which the team is hitched, forming a simple and durable device by which the team will be detached from the plow when the latter strikes a rock, root, or other obstruction.

Miscellaneous.

CLOTHES LINE PROP. — William B. Adams, Greenfield, Ohio. This is an extensible prop stick for the support of stretched and filled clothes lines, whereby the line may be held at the desired elevation, while the stick may be closed together to reduce its height, affording a light and compact device.

VENT BOX. — Walter E. Warner, Brooklyn, N. Y. This box has ventilating surfaces, a bottom outlet, an aperture in one side surrounded by a coupling, and means for attaching the body to a support, being designed for use in connection with the plumbing system of buildings, the boxes discharging any foreign matter entering and providing at all times for a perfect circulation of air.

BEDSTEAD ATTACHMENT. — James B. Hill and William D. Gohn, Zilwaukee, Mich. This is an outrigger device consisting of a mattress frame having at one end a hook adapted to drop over and grasp the top edge of the bed rail, with a hinge connection at the other end to permit the mattress frame to be swung around and folded behind the head board, the device being designed to take the place of a cradle or crib for accommodating a baby at the side of the bed.

CAMERA STOP. — Lyman G. Bigelow, Chattanooga, Tenn. By this invention the stop or diaphragm for a photographic camera is made with a central opening surrounded by an annular network, or a translucent or transparent film, tinted or lined or stippled, to cut off only a portion of the marginal rays, the light passing freely through the center, the design being to soften the image while retaining its clearness of definition.

PALATE PLATES. — Ludwig Pritzius, Ludwigshafen-on-the-Rhine, Germany. This invention relates to the making of caoutchouc plates for artificial teeth, and provides an apparatus by means of which the plates may be accurately moulded and rendered hard and dense, the apparatus being free from danger of explosion during the manufacture.

DIE FOR MAKING JEWELRY. — Henry B. Veit, New York City. A longitudinally channeled steel stock is provided, adapted to receive a series of independently engraved or embossed dies, to form different combinations, clamping plates and screw bolts being secured to the ends of the die stock to hold the dies in place, the composite die being as efficient as a solid die, and accomplishing a saving of expense in a factory manufacturing jewelry.

CANNON PINION FOR WATCHES.—Frank P. Allen, Fort Gaines, Ga. This invention provides means for adjusting the cannon pinion to the arbor of the center wheel with a constant frictional contact, a concave spring being interposed between a shoulder on the arbor and the inner end of the cannon pinion, while a concentric countersunk screw holds down the pinion on the arbor and compresses the screw.

SEWING MACHINE.—Clarence Harman, Omaha, Neb. This invention covers improvements in the shuttle-carrying mechanism, the stop motion, and the feed mechanism and regulator, designed to make a simple, strong and inexpensive machine which will be as efficient in operation as more complicated machines.

FIRE ESCAPE. — George W. Bowman, Red Cliff, Col. This escape is made in the form of an easy chair, so constructed that in its descent a guy tape or rope will be so wound as to return the chair from the ground to the elevation it had descended from, a simple form of brake being provided whereby the occupant of the chair may regulate the rapidity of its descent.

SASH BALANCE. — William Cashner, Pleasant Hill, Mo. By this invention the upper and lower sashes are supported by suspension cords secured to pulleys actuated by springs contained in them, the pulleys being on a shaft journaled in bearings in uprights to turn in either direction, and both the springs being called into play by the lowering of either sash.

BELL CORD ATTACHMENT.—George A. La Fever, Selkirk, N. Y. In connection with a clamping device for holding the cord is held a knife or chisel and operating mechanism to cut the cord, the device being designed for attachment to railway cars, to cut the bell cord when the cars separate accidentally.

SPRING HINGE.—Herman A. J. Rieckert, New York City. The hinge casing has one closed end in which is a helical spring against which rests a sliding ring having a cam-shaped opposite face and means to prevent its rotation, a pivot or pintle entering the open end of the casing and having the face of its inner extremity shaped to correspond with the cam face of the ring, the hinge being adapted to support heavy doors and render them self-closing.

BOLT.—Frank W. Wallace, Utica, Miss. This invention relates to double bolts arranged at the top and bottom for half doors which meet in the middle, divided window shutters, etc., and provides for simultaneously operating or drawing such bolts, instead of pulling on a hanging chain for the upper bolt and drawing the lower one by hand, etc.

LAWN SPRINKLER.—Robert Franken, Pomona, Cal. This is a sprinkler in which the force of the water automatically revolves the discharge pipe to distribute a fine spray of water around, the stand pipe having an air chamber thereon, and a joint sleeve extending throughout the length of the guide tube, with other novel features, whereby the head joint is made water-tight, and any leakage is avoided.

POULTRY DRINKING FOUNTAIN. — Glenn C. Burrell and Edwin H. Roblee, Canisteo, N. Y. This fountain has a reservoir and trough fitted in a heater receptacle, whereby the water supplied is heated while in both the reservoir and trough, and the water will be kept in a clean and wholesome condition and furnished in sufficient quantities for the poultry.

COMBINED BED AND LOUNGE.—Henry Burgess, Chicago, Ill. Combined with the frame is a folding back adapted to be let down into the frame into a horizontal position to complete the bed, the article having the ordinary appearance of a lounge, and being capable of use as a lounge and as a receptacle for bed clothing.

HAT OR BONNET BOX. — Andrew C. Mack, Portland, Oregon. This box is made of triangular shape in cross section, of card board or other suitable material, and preferably foldable, the construction being specially designed for the packing of millinery, hats or bonnets for shipment, so that the hat will be held stationary and the trimming cannot be crushed.

WAIST AND SKIRT. — Camille Caen, New York City. This is a combination garment so made that all the under garments may be attached to a single waist, to which the skirts and other underwear are so connected that their weight is sustained mainly by the hips, leaving the waist and adjacent parts of the body untrammeled.

SHIRT AND SUSPENDERS. — Herman Peiter, Norwalk, Conn. According to this invention, two endless bands are secured to the shoulder portions of the shirt around the armholes, on the interior, and pendent suspender pieces are extended through slits in the shirt to the bights of the endless bands, there being adjustable button straps on the suspender pieces.

PAINT.—John H. Baker, Chicago, Ill. This paint is composed of linseed oil, white lead, water, plaster of Paris, a drier, and other ingredients, in specified proportions, designed to make a paint that will be thoroughly water and weather proof, and will not crack, blister, or become sticky with exposure to the sun or weather, while also being a non-conductor and not affected by frost.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE CHEMISTRY OF IRON AND STEEL MAKING AND OF THEIR PRACTICAL USES. By W. Mattieu Williams, F.C.S., F.R.A.S. London: Chatto & Windus. 1890. Pp. ix, 420. Price, $3.00.

The well known author of this book, having been formerly chemist in the works of Sir John Brown & Co., of Sheffield, may be considered as speaking *ex cathedra* in treating of iron and steel. The subject is one of never-ceasing interest to the modern scientific reader, and Mr. Williams' distribution of material exhibits peculiarly good judgment. Starting with the ores of iron, their reduction and dissociation, the blast furnace, puddling, manipulation, and physico-chemical changes of iron and steel are treated. Impurities and their effect, the Bessemer process, and a theory of steel are suggestive titles. Under fluxing, the author gives his theory of soldering, to which, however, full adherence can hardly be given. It is exceedingly doubtful if resin used as a flux in soldering reduces the oxide of tin, as the heat is so low. This is the theory proposed by the author. In treating of sal-ammoniac as a flux he curiously omits the analogous effect produced at ordinary temperatures on mercury by an aqueous solution of mercuric chloride. Any one who has worked with the blowpipe will also be inclined to doubt his theory of the volatilization of borax carrying with it a dissolved oxide in the brazing process.

THE CENTURY DICTIONARY. Vol. 4. M to P, inclusive. Pp. 1323, 1,500 illustrations. The Century Company, New York.

The fourth volume of this monument of American scholarship does as much as its predecessors to establish the character of the book. It is really of dual character. It is in the first place a dictionary. As an instance of this the editors cite the word *put*, which is treated etymologically and lexicographically in seven columns, including 17 definitions and 169 special phrases. But to keep abreast of the times a quantity of special words, trade and scientific terms, had to be given. These in many cases are illustrated with cuts in the text. From these the work acquires an encyclopedic cast. Thus its possessor will have at once a dictionary of about 225,000 words and an encyclopedia. Our space, it is evident, is quite insufficient for a review of this really magnificent work. We trust in the future to notice the successive volumes, of which two are yet to come.

SCIENTIFIC AMERICAN

BUILDING EDITION.

JANUARY NUMBER.—(No. 63.)

TABLE OF CONTENTS.

1. Handsome colored plate of an elegant residence on Riverside Avenue, New York City. Cost $60,000 complete. Floor plans, two perspective elevations, etc. Mr. Frank Freeman, New York, architect.
2. Plate in colors showing an attractive cottage at Maplewood, Chicago. Estimated cost $3,000. Perspective view and two floor plans.
3. A cottage at Rutherford, N. J., erected at a cost of $6,000 complete. Perspective elevation, floor plans, etc.
4. An elegant residence at Chestnut, Hill, Pa., recently erected for Mr. Alfred C. Rex. Cost $30,000 complete. Floor plans, perspective elevation, etc.
5. Sketch and floor plans of a residence at Stockton, Cal. Estimated cost $10,000.
6. Cottage at Englewood, Chicago. Perspective view and floor plans. Cost $4,200.
7. Residence on Powelton Avenue, Philadelphia, Pa. Cost $30,000 complete. Architect Thos. P. Lonsdale, Philadelphia. Floor plans, perspective elevation, etc.
8. A cottage at Jackson Park, Chicago. Estimated cost $4,000. Floor plans, perspective elevation, etc.
9. Cottage on Munroe Avenue, Chicago. Two floor plans and perspective view. Cost $900.
10. Residence at Wayne, Pa., from plans prepared by W. L. Price, architect, Philadelphia. Cost $7,000 complete. Floor plans, perspective view, etc.
11. An attractive country church of moderate size recently erected at Glen Ridge, N. J. Estimated cost about $15,000. Perspective view and floor plan.
12. Cottage at Lakeview, Chicago. Floor plans and perspective view. Cost $3,000.
13. A stable combining both beauty and convenience, erected for Mr. A. C. Rex, at Chestnut Hill, Pa. Cost $1,800. Plans and perspective.
14. A cottage at Austin, Chicago, Ill. Cost $4,200. Two floor plans and photographic view.
15. Sketches of park entrance lodges.
16. Engraving of the Woman's Temperance Temple, Chicago, Ill., as it will appear when finished. Estimated cost of the Temple $1,100,000.
17. View of Whitworth Memorial Hospital.
18. Miscellaneous contents: The marble industry.—Lighting streets of London.—Mahogany ties and marble bridges.—Staining floors.—The Peruvian temple of Pachacamac.—How to catch contracts.—Black birch.—Some of the merits.—Improve your property.—The SCIENTIFIC AMERICAN a help to builders.—An improved article for plastering, tiling, and cement work, illustrated.—The Sinclair double rocker, illustrated.—An improved veneer press, illustrated.—Our last year's volume.—The Albany Venetian blinds, illustrated.—A convenience for hospitals, families, etc., illustrated.—The education of customers.—The Buffalo hot blast heating system, illustrated.—The "Willer" sliding blinds, illustrated.—Mueller's water pressure regulator.—Artistic wall decorations.

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The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

For Sale.—Farrel Foundry and Machine Company six ton iron crane, 20 feet radius, and in perfect order, together with iron and stone base. Nearly new. Apply to Charles Warner Company, Wilmington, Del.

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions, etc. ☞ *A profitable business for a man with small capital.* Also lanterns for home amusement. 208 page catalogue *free*. McAllister, Optician, 49 Nassau St., N. Y.

Wanted—Postion as assistant to superintendent of manufacturing concern in or near New York, by young engineer (24) experienced as draughtsman on mechanical, architectural and topographical work, also accustomed to use of field instruments, transit, level, etc. Several years' experience in factory. Can give reference. Address "Engineer," 35 Wall St., N. Y., 8th floor, room 25.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(2672) Optician writes: 1. It happens quite often in my business that I receive rubber eyeglass frames as well as zylonite eye glass frames, broken, for repair. I do not know of any method by which such broken frames could be successfully rejoined without the use of wires, etc., and you would greatly oblige me by explaining to me the method required to accomplish it. A. You cannot satisfactorily mend these articles. A special cement is sold for zylonite, but there is little chance of your securing a good joint without riveting. 2. I would also like to know if there is a fluid or chemical compound that will make old steel frames for eyeglasses blue again, or if there is any way to blue any steel frame outside of the heating process. A. After polishing, lacquer with shellac and alcohol colored with aniline or Prussian blue. 3. How to polish or rather repolish the brass parts of a telescope or microscope if they are shop work, so as to look like new again, possessing that goldish, fine appearance? A. For polishing use putz pomade, followed by the finest rouge. The lacquered parts must be coated while warm. The smallest trace of oil will injure the work. 4. How is the gold finish put on opera glasses? A. By electroplating. 5. How can I figure out the power of a telescope, microscope, or field glass? A. As a practical test for small telescopes, etc., look at a brick wall with one eye looking through the glass and the other looking directly at the wall. Count the divisions between the bricks as seen through the glass corresponding to a single brick as seen directly. This gives the magnifying power. For a microscope the following is a practical rule: A stage micrometer is placed in the field, and the instrument is focused on it; with a camera lucida a convenient number of divisions of the micrometer is drawn upon a piece of paper. The divisions are measured and their relation to the true size of the scale gives the magnifying power in diameters. A camera lucida can be improvised from a cover glass fixed at an angle of 45 degrees to the eye piece by a lump of beeswax.

(2673) W. G. M. asks: 1. What is the cheapest known freezing mixture and how is it used? A. 1 part salt and 2 parts ice, or 1 part nitrate of ammonia and 2 parts water. The latter can be used and then the salt can be recovered by evaporation. 2. What is the least expensive to liquefy sulphurous acid, after it has been converted into a gas? A. Pressure. 3. About what will be the cost per year of operating an electric light plant of eight incandescent lights, the lights to burn about ten hours per day, and not considering the cost of power? A. Four lamps will represent 80 lamp hours per day or 29,800 lamp hours per year, representing

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about $25 consumption of lamps alone. Attendance, oil, and general maintenance cannot possibly be estimated without full knowledge of the case. It would require a comparatively small portion of a man's time. 4. Where is the Herreschoff marine coil boiler made? A. The Herreschoff Manufacturing Company, Bristol, R. I.

(2674) G. C. W. asks (1) for formula for arsenic complexion wafers. A. Arsenic should only be taken internally under advice of a physician. 2. Recommend books for the beginner at pattern making. A. We recommend "The Pattern Maker's Assistant," by Joshua Rose, price $2.50, which we can supply. 3. Give number of SCIENTIFIC AMERICAN or SCIENTIFIC AMERICAN SUPPLEMENT that gave directions for laying out and making a photographic camera bellows out of paper. A. We refer you to SUPPLEMENT, No. 625.

(2675) W. E. D. writes: On examination of a burned-out Edison incandescent electric lamp (16 candle power), I noticed around the inside of the neck of the globe a very thin deposition of what appears by reflected light to be copper. But on looking through it as it is translucent, the substance is of a beautiful chlorine green. Will you please tell me whether it is copper or not? Why does it appear green by transmitted light? What probably caused the deposit on the inside of the vacuum globe? I have observed but two or three instances of such a thing, and am much puzzled at the phenomenon. The deposit always takes place in a burned out globe. A. The phenomenon you describe has often been observed. It is due to the deposition of an exceedingly thin film of metallic copper, which, like gold, is green by transmitted light. The green is complementary to the red color shown by reflected light.

(2676) J. H. B. asks how large copper pipes are brazed and bent, say 4 inches to 6 inches diameter, and whether flanges to be attached to such pipes by brazing require a special mixture or will any ordinary brass answer? A. The seams are filed off so as to come accurately together. They may be lapped or butted. In the latter case the metal may be cut into teeth, so as to constitute a species of dovetailing. Spelter, an alloy of zinc and copper, is used in powder or in sheet as the brazing material. As flux, borax which has been heated to expel almost all the combined water and has then been powdered, is used. The borax and spelter are placed on the line of the joint, and heat from a blow pipe, blast lamp, hearth, or oven is applied. As the borax melts it runs into the joint by capillary action and is followed soon after by the melting spelter. The pipe must be held absolutely stationary as regards the joint, and as needed, more borax or spelter may be supplied during the process. More will be learned from seeing it done than from any description. The bending is done by rolls and by hammering. Special brass is sold for the brazing. The same answers for joints and flanges.

(2677) R. A. asks: How many feet of illuminating gas will a gallon of 88° gasoline make in a carbureter where the air is passed through the gasoline in small jets under pressure? Are there any works published in which full data is given, about gas made from hydrocarbon oils? A. Reliable data on the above matters are wanting. The custom is not to meter the gas thus made, and hence the difficulty of getting accurate data. As regards true gas made from naphtha, it is treated of in works on gas making. It is used as an addition to water gas, in quantities produced by from 3 to 6 gallons of naphtha per thousand cubic feet of finished gas.

(2678) W. C. Van N. writes: On page 400, of vol. lviii., there was a description of a new style of pad for hektographic work. In trying to use it I made a failure. At least the work was not satisfactory to me. Can you tell me whether it has proved a success? There is a machine for sale called the "express duplicator," which it is claimed duplicates without the trouble of washing the pad. Is it simply the pad described in your paper? If properly managed, will the pad described by you do the work claimed by the duplicator? A. The pad, if properly prepared, should work. It is supposed to require no washing off, the blotting paper absorbing the ink. We can only suggest a new trial. Be careful to use the best quality of blotting paper. It corresponds substantially in its alleged working with the "duplicator" you mention.

(2679) G. W. L. asks: How long must two cylinders of tin or galvanized iron, 1 foot in diameter, be to support 200 pounds on the water and not sink over 6 inches? They are to be used in connection with a water cycle and air tight. A. Much depends upon the weight of the iron that you make the shells of, in the computation of the floatation. If made of very light iron and with proper lines for speed, the cylinders should be not less than 12 feet long; 14 feet would give better results. They would not sink 6 inches if of proper lightness.

(2680) W. R. asks how to make a bright green ink from verdigris (copper acetate). A. You can approach to what you want by mixing verdigris with a solution of shellac in borax water. It will be very imperfect as an ink.

(2681) F. H. V. asks: 1. Can you inform me through your paper what is used in painting blackboards? I have painted one, but it does not seem to take the chalk very easy. A. Mix lampblack and ground pumice with shellac varnish. See queries No. 2453 and 2454, for more elaborate formulas. 2. Is there any kind of cement with which to fasten leather to iron? A. Make strong glue, while hot mix with it tannic acid and apply at once while hot. Bind firmly until dry.

(2682) G. C. asks for the best process to soften a cow's horn, so as to straighten it? A. Immerse in boiling water.

(2683) S. B. B. asks the best methods for testing old gold for its purity. Also the best tests for silver. A. An assay or analysis is the only good method. Gold should dissolve in a mixture of one part nitric with three parts hydrochloric acid. A residue indicates silver. If sulphuric acid is added to the solution, a precipitate indicates lead. One quick method is to determine its specific gravity. Silver may be dissolved in nitric acid. It should, with excess of ammonia, give a colorless, clear solution. Sulphuric acid may be used to test for lead.

(2684) G. S. writes: A man has a field whose sides are to each other as 5 to 6; if one foot be added to each side, it will contain 304 square feet. What are the lengths of the sides? A. Calling the length in feet of one side x, and of the other side y, we have the proportion:

$$x : y :: 5 : 6 \text{ or } x = \frac{5}{6} y \qquad (1)$$

From the conditions of the problem we have

$$(x+1) \times (y+1) = 304 \qquad (2)$$

substituting $$\left(\frac{5}{6} y + 1\right) \times (y+1) = 304$$

reducing $$y^2 + 22\,y = 3336$$

solving $y = 18$ feet.

$x = 15$ "

The problem cannot easily be solved by pure arithmetic.

(2685) J. S. writes: How should I connect coil with cells, in a pocket battery? Battery is a physician's battery with three cells, current breaker and induction coil. A. If the connections are broken, you will probably find their remains under the case in grooves, possibly covered with a thin board or with pasteboard. Connect your battery thereto, one end to each connection.

(2686) H. W. R. writes: I have two jars of acid deadened with zinc; one jar I used sheet zinc, the other I used zinc out of galvanizing pot; the one with sheet zinc I can use, the other I cannot use; when the iron is put through the latter, the tin will not stick, but it will when put through the acid with the sheet zinc. Can you tell me the cause of this? A. A good soldering fluid must be pure. It should contain only chloride of zinc and sal ammoniac. The zinc from the galvanizing pot has become contaminated with iron and other impurities, and hence gives an impure soldering fluid.

(2687) C. A. C. asks for a preparation for cleaning kid gloves to take the blackness off. A. Use bread crumb or India rubber sponge. They may also be rubbed off with benzine, which, however, gives them an unpleasant odor. See query No. 2670.

(2688) E. C. W. asks: 1. What is the effect of glycerine added to tobacco? A. It keeps it soft. 2. What will keep cut tobacco moist in packages? A. Glycerine. 3. What will keep it from getting musty? A. Add no glycerine, but keep it dry. 4. Is opium ever used in tobacco, and what is a safe proportion? A. Yes; but we would discontenance any such use of it.

(2689) A. T. asks: Can you suggest a convenient method by which one could index the Notes and Queries, one of most valuable features of the paper, for future reference? A. We do not know of a better way to index Notes and Queries than by using an index book with the edge cut to show the letters at a glance. Enter the subject by the letter that begins the word that represents the principal point in the Notes and Queries. Follow on the same line with the date and number between vertical ruling. A card catalogue is more thorough but less compact.

(2690) P. J. L. asks: 1. If an electric motor were used to run a dynamo, would the dynamo develop more electricity than the battery that would be necessary to work the motor? If so, about what proportion? A. No; there will be a loss of probably 40 to 60 per cent. 2. About how many candle power in a common gas jet? A. Twelve to twenty-five, according to size, material, and state of jet and quality of gas.

(2691) E. P. A. asks the meaning of the term "A curve of versed sines." I know what a versed sine is, and have a table of such sines, but am puzzled to understand how they can form a curve. A. On a horizontal line lay off equal distances representing lengths of specific arcs of a circle of given radius. On each division erect a perpendicular equal to the versed sine of the arc of that radius and length. The curve connecting the tops of such lines will be the curve desired. The formula reads $y = ver.\ sin.\ x$. A constant may be introduced, making the formula read $y = a\,ver.\ sin.\ x$.

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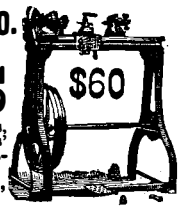

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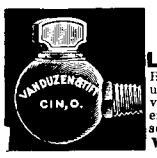

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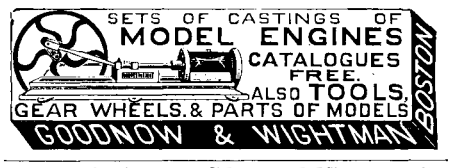

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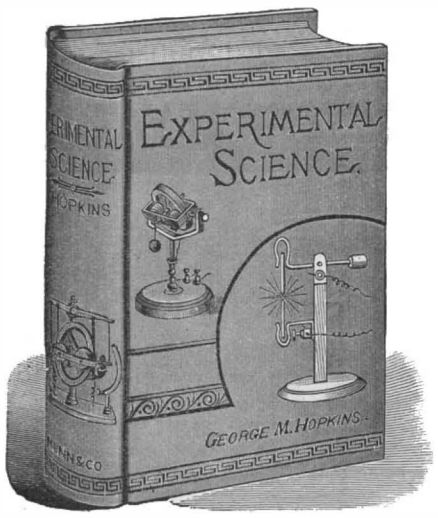

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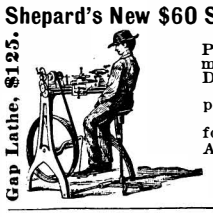

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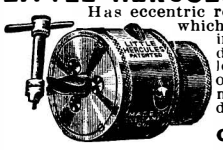

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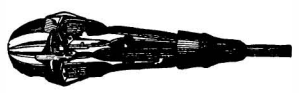

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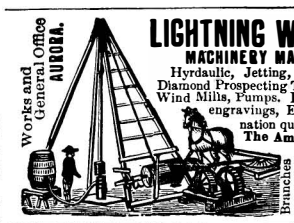

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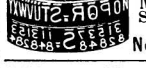

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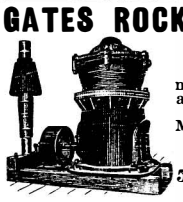

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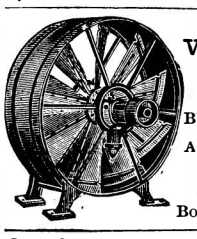

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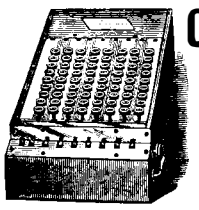

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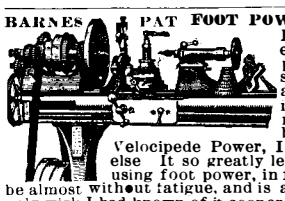

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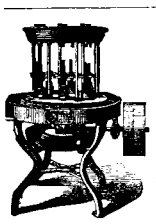

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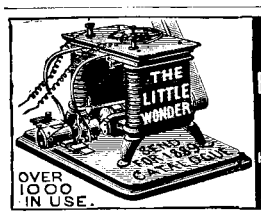

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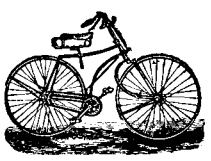

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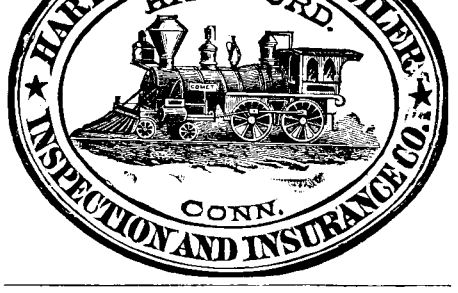

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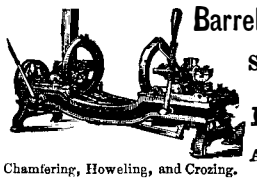

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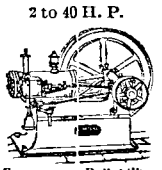

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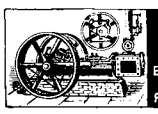

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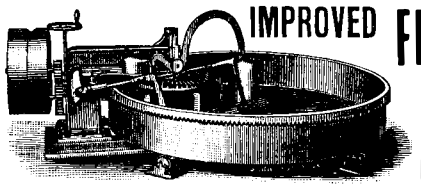

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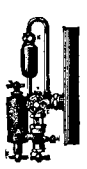

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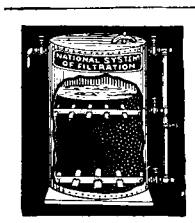

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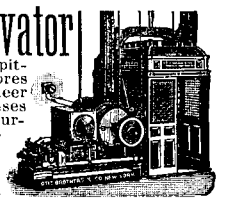

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